U.S. Department of Agriculture
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INVESTIGATIONS OF METHODS OF APPRAISING THE ABUNDANCE OF MOURNING DOVES

SPECIAL SCIENTIFIC REPORT: WILDLIFE No. 17

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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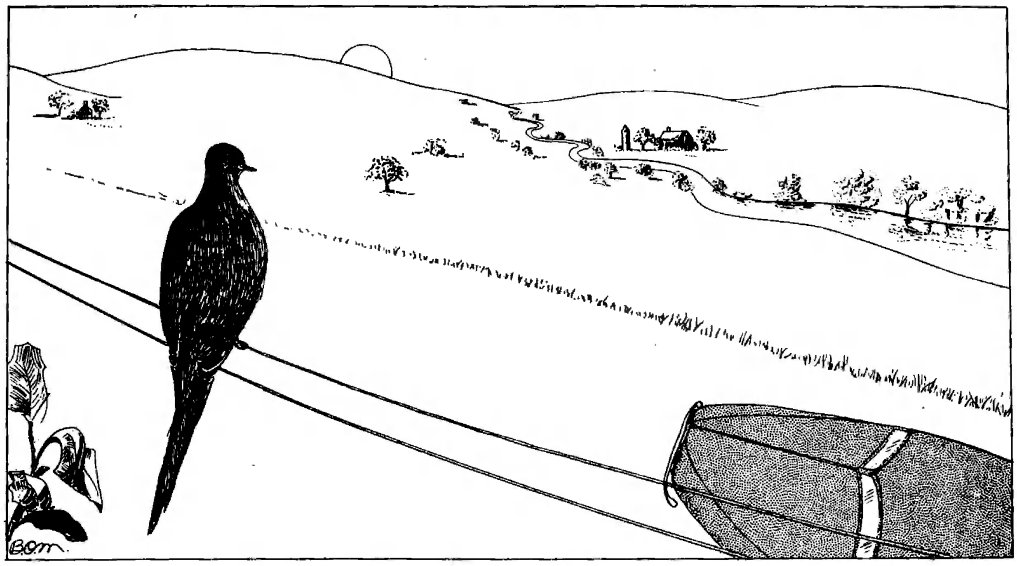
INVESTIGATIONS OF METHODS OF APPRAISING THE ABUNDANCE OF MOURNING DOVES



Special Scientific Report – Wildlife No. 17

United States Department of the Interior ..... Oscar L. Chapman, Secretary
Fish and Wildlife Service ..... Albert M. Day, Director

and

Georgia State Game and Fish Commission
Tennessee Division of Game and Fish
Wisconsin Conservation Department
University of Georgia
University of Tennessee
University of Wisconsin
Wildlife Management Institute

WASHINGTON : SEPTEMBER 1952

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INTRODUCTION

by

Leonard E. Foote, Wildlife Management Institute
and
Harold S. Peters, U. S. Fish and Wildlife Service

This report is a summary of the results of a series of closely related, intensive investigations designed to develop a reliable index to the Mourning Dove population.

Most of the research leading to the development of the "call index" has been done concurrently at different latitudes in the eastern United States as part of the Cooperative Dove Investigation which was organized late in 1948. In this investigation, the State Game and Fish Commissions, the U. S. Fish and Wildlife Service, several universities, the Wildlife Management Institute, other private organizations and many individuals have pooled resources and manpower in an effort to determine essential population phenomena with the objective of improved hunting regulations for the Mourning Dove.

Coordination of activities under the Cooperative Dove Investigation has been primarily the responsibility of George C. Moore, Assistant Supervisor, Branch of Federal Aid, Fish and Wildlife Service; Harold S. Peters, Research Biologist, Branch of Wildlife Research, Fish and Wildlife Service; and Leonard E. Foote, Field Representative, Wildlife Management Institute. Credit for the original idea of adapting an auditory index to doves is more or less equally shared by Moore; Peters; Foote, Edward Wellein, Flyway Biologist, Section of Waterfowl Investigations, Fish and Wildlife Service; and Daniel J. Nelson, Federal Aid Project Leader, Georgia State Game and Fish Commission. Wellein and Foote started the original discussions of the possibilities of the method which has been founded upon the basic researches of H. Elliott McClure a decade ago (McClure, H. E., 1939, Cooing Activity and Censusing of the Mourning Dove, Jour. Wildlife Mgt. 3: 323-328). Peters, Nelson and Foote ran a three-car, half-mile interval call route in March, 1950, which was followed by Foote's Georgia evening counts in May, 1950. Allen Duvall and Chandler Robbins, Branch of Wildlife Research, Fish and Wildlife Service, experimented with call counts at measured stops along routes in Maryland, Pennsylvania, and New York in May and June, 1950, and Peters followed similar procedures in Ohio in June, July, and August of that year. The chief results of these earlier studies were the determination of the practicability of certain procedures in the call count method, particularly the distance between stops, the length of these stops, and the time of day and duration of the count. Coordinated research was proposed during late 1950 and begun in 1951 after statistical analysis of the 1950 data.

Standardized procedures were suggested for testing the call count so that the results could be subjected to statistical evaluation. Closed course routes of 20 stations at intervals of one mile to be censused in the early morning and early evening were suggested so that the resulting data from different latitudes could be compared intelligently. Weather, land use, and other factors affecting either the human ability to hear or the dove calling intensity were considered in order to permit evaluation of the effects of these factors in relation to the annual calling cycle. It was thought important that the resulting technique be broad enough in scope for use throughout the range of the Mourning Dove and permit area to area comparisons which could not be made through other indexing methods.

Marked similarities will be seen in the results of these intensive investigations from five areas in the eastern United States. During 1951 the seasonal picture of Mourning Dove calling activity in different parts of the range was relatively uniform, usually with a pre-plateau peak in late April and early May which was followed by approximately a month of near-level calling activity. Data agree that from late April into July, calling levels are quite stable from station to station, indicating some degree of territorialism and no marked shifting of the calling population during this period. All data agree that the population is more homogeneously spread throughout the range during this period than at any other season (cf. Nelson, 1951, Statistics as a Tool in Measuring Dove Inventories, 8 pp., Mimeo. Oct.; Foote, Moore and Peters, 1951, Mourning Dove Newsletter, No. 4, June 30, Summary Progress Report, Mourning Dove Study Report, 1952). Two studies indicate a relationship between calling birds censused and absolute numbers of calling birds, and one study calls attention to human variations in hearing and in interpreting numbers of birds calling. The data show a significant relationship (probably curvilinear) between calling rate and numbers of individuals calling.

These distinct similarities plus the statistical reliability of the data early suggested that an economical census index could be developed from these researches. Since the Cooperative Dove Investigation sought to secure management data as well as the necessary techniques, during 1951 a total of 101 transects were sampled in various states east of the 100th meridian, statistically allowing designation of a 13 percent calling population change 95 percent of the time. Plans for the 1952 counts, call for an increase to 176 transects to secure a better distribution of the sampling and (with the same variation) to allow prediction of a 10 percent calling population change 95 percent of the time.

A high degree of personal cooperation has been continually manifested in the Cooperative Dove Investigation. Biologists working throughout the eastern part of the Mourning Dove range have exchanged progress data freely and allowed its use in the "Mourning Dove Newsletter" series in order that all workers might be kept informed promptly. This report again is a cooperative endeavor since it represents research financed by the Fish and Wildlife Service, Branches of Wildlife Research and Federal Aid; the Georgia Game and Fish Commission; the Tennessee Division of Game and Fish; the Wisconsin Conservation Department; the University of Georgia; the University of Tennessee; the University of Wisconsin; and the Wildlife Management Institute. Each of the papers in this report is intended as a separate contribution and there have been no editorial changes made in the original treatment of subject matter. Full credit should go to the individual authors. Many individuals, State and Federal employees, and students have contributed abnormal working hours to record the data herein summarized. Without the friendly cooperation of all concerned, these parallel investigations could not have been made.

AN INTENSIVE STUDY OF THE CALL COUNT AS A CENSUS METHOD FOR MOURNING DOVES ON THE GEORGIA PIEDMONT

By Terry A. McGowan

University of Georgia and Georgia Game and Fish Commission *

The present paper is a report on the first year's results of a two year study. In March, 1951 an experimental 20-mile route which has now become standardized in the Cooperative Dove Investigation was laid out in Oconee County, near Athens, in the piedmont region of Georgia. The route (Figure 1) forms a nearly closed circle on secondary roads and has 20 stations located approximately one mile apart, only one station being on a paved road. The route crosses no large streams and passes through typical upland piedmont farmlands with small grain, cotton, and corn fields, abandoned fields, pastures, pine and mixed pine-hardwood woodlands. A "count" required two hours with three minute stops at each station and three minutes driving time between stations. The number of doves calling and the number of calls are recorded for each station, and the number of doves seen at and between stations noted. Between March 8 and September 24, 1951, totals of 37 morning and 37 afternoon counts were made by one observer (the author, except for several counts early and late in the season), beginning at station one. Counts were not run in rainy weather or when the wind was any greater than Beaufort three. Morning counts always began one-half hour before official sunrise and afternoon counts two hours before sunset. Weather permitting, morning and afternoon counts were consecutive, either on the same day, or afternoon of one day and morning of the next. In addition to these "one-crew" counts, a "five-crew" count was made morning and afternoon once a month, March through August. On these counts one or two observers start simultaneously at stations 1, 5, 9, 13 and 17 and continue around the circuit to the starting point.

This study was suggested by Harold S. Peters of the Fish and Wildlife Service and Leonard E. Foote of Wildlife Management Institute, and is being directed by Dr. Eugene P. Odum of the University of Georgia. Travel funds, financial aid and a truck were supplied by the Georgia Game and Fish Commission. In addition to the above persons the following helped with one or more counts: Dan Nelson, Jack A. Crockford, Game and Fish Commission; George Moore, Dr. Clarence Cottam, Fish and Wildlife Service; James H. Jenkins, Henry Robert, Charles Lowe, and Milton Hopkins of University of Georgia.

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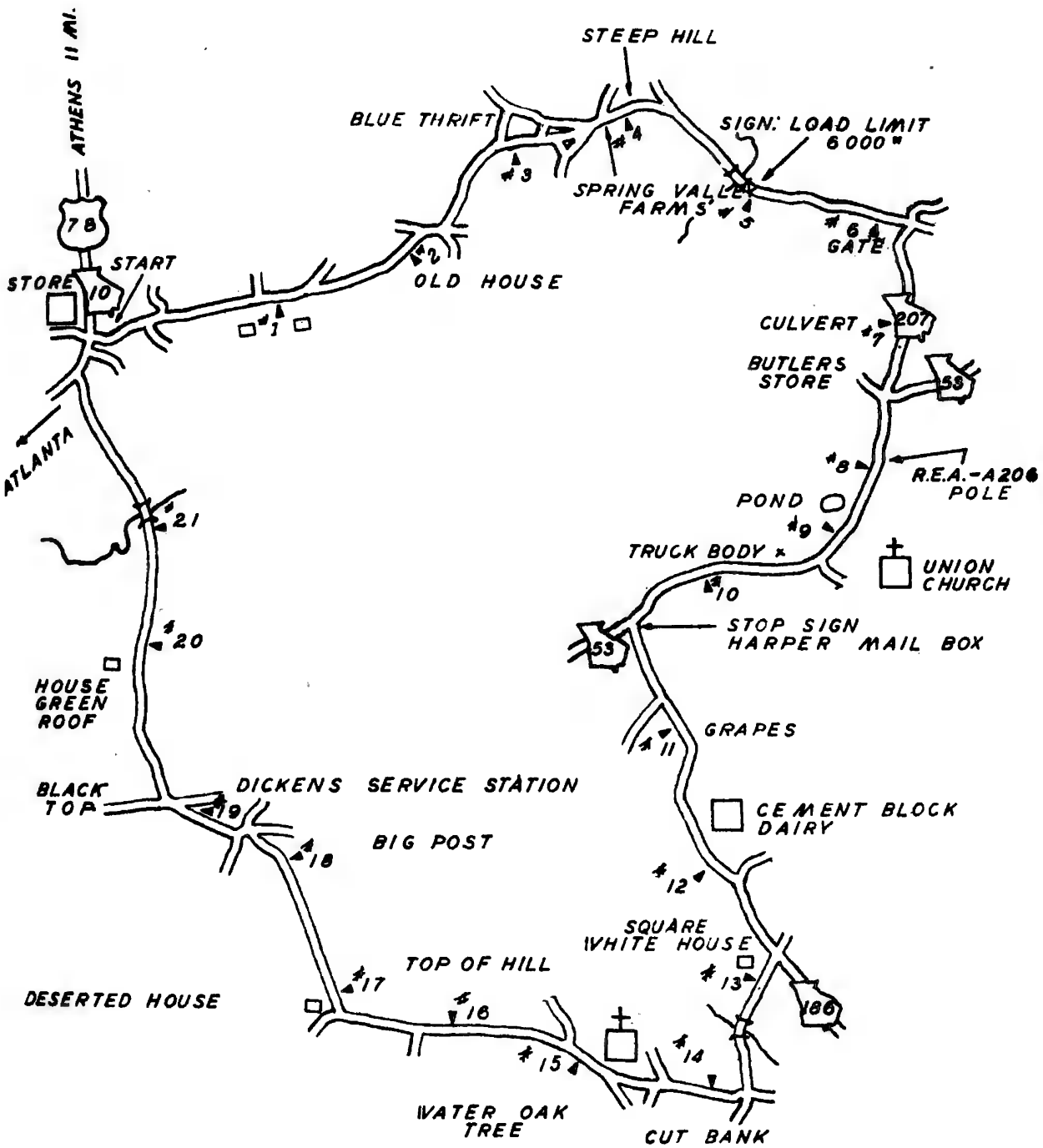
* A contribution from Pittman-Robertson Wildlife Restoration Project 17R. Experienced observers,--graduate students, instructors of personnel from Atlanta State and Federal offices,--participated in these counts. These intensive counts made it possible to determine changes in calling levels during the two hour census period and to evaluate calling activity at each station independent of the time factor.

FIGURE 1

DOVE CALL COUNT CENSUS ROUTE

OCONEE COUNTY, GEORGIA

20 STATIONS APPROX. 1 MILE APART



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"One-crew" Counts

The total number of doves heard and seen on the 37 afternoon and 37 morning counts are plotted in Figure 2. As was expected, the number of birds seen was much more variable than the number heard: the roadside count portion of the census is probably of little value except possibly to indicate appearance of young birds or occurrence of dispersal movements in late summer. As may be seen in Figure 2, morning call activity remained at a low level in March and early April, increased abruptly in late April, and reached a rather consistent plateau between May 10 and June 15, following which a gradual but persistent decline occurred. Afternoon counts were one-third or less as large, but approximately the same seasonal trend occurred. The April rise coincided with a rise in early morning temperatures from 40-45 to 60-65° F. Counts were quite consistent when run at short intervals (2-3 days) in good weather. Wind proved to be a very important factor; as already indicated counts were not made in strong wind but even at Beaufort 2-3 counts were lower, especially early in the season. Wind apparently reduces calling activity and also makes it more difficult for the observer to hear doves. The number of calls per dove heard at 3-minute stops increased from 3.8 in March and early April to 6.2 during the peak of the season (May-June). The coefficient of variation of morning counts between May 10 and June 15 (peak season) is 13.8 and for afternoon counts 26.7.

"Five-crew" Counts

To determine the variation in calling activity during the two hour period the number of doves heard at the first four stations visited by each of the five crews were totaled, then the total for the next four stations obtained, etc. In this manner, total doves heard by more or less simultaneous observation at all stations at approximately 30 minute intervals was obtained. As may be seen in Figure 3, calling activity in the morning is very definitely less the second hour (or 30 minutes after sunrise), as compared with the first hour (or around sunrise). In the afternoon, however, calling did not consistently increase or decrease during the two hour period before sunset. This means that during a morning count by one crew, the last half or so of the route will be subject to time bias; the results obtained at the last stations will not be directly comparable with results obtained at stations visited during the first hour, or in other words, fewer doves will be heard at the end of route even if the population is the same as at the beginning. In Figure 4, the time bias is removed (5-crew count data) and each of 20 stations evaluated as to morning calling activity. The index used is the total number of doves heard at the station by all five crews multiplied by the number of crews (1-5) recording doves at the station. During April, May, June and July at least one dove was heard by at least one crew at every station while all crews recorded doves at the more active stations. Figure 4 indicates that there were no pronounced shifts in

population along the route between April and July since the activity index remained roughly the same for each station. Thus, stations 5, 10, 12, 15, 20 which showed high activity in April and May remained in general as "best" stations in June and July. It is interesting to note that one or two "good" stations alternated rather consistently with "poor" stations all along the route (Figure 4); this indicates that breeding doves were fairly evenly distributed along the route, but tended to concentrate to some extent. This agrees with our general observation that in Georgia doves show a moderate colony nesting behavior, but do not concentrate in large colonies as reported for some mid-western and southwestern areas.

The Relation of Actual Density to Call Counts

During May and June Hopkins and Odum determined by means of the spot-mapping method that the actual breeding population of a 100-acre area with station 10 as the center was four pairs. Both five-crew and one-crew counts indicated that station 10 was one of the most active stations with from one to four doves being heard consistently; the average for May and June on one-crew counts was 2.6 doves heard per 3-minute stop. Plans for second year's study call for population density determinations for a number of stations in order to establish more definitely a correlation between call counts and actual breeding density.

Morning vs. Afternoon Counts

While morning counts are consistently higher and less variable than afternoon counts at the peak of the season, there is much to be said for the afternoon count as a practical index for future use in determining population trends. As shown in Figure 3 there is less time bias and more equal sampling of all stations along the route. Most important, however, is fact that cooperation of wildlife rangers, busy state and federal personnel, and voluntary observers will likely be much greater with afternoon counts than with morning ones. Early morning counts in May and June are hard on the health of persons who have full time duties in other matters.

The Relation of Call Counts to Production

It is interesting and perhaps significant that both the magnitude and form of the morning counts' curve shown in Figure 2 is very similar to that obtained by Wagner in Wisconsin. If the level of calling is directly correlated with actual nesting activity, a relation not yet definitely determined, this comparison suggests that the breeding season

FIGURE 2. Total doves heard and seen on one-crew counts

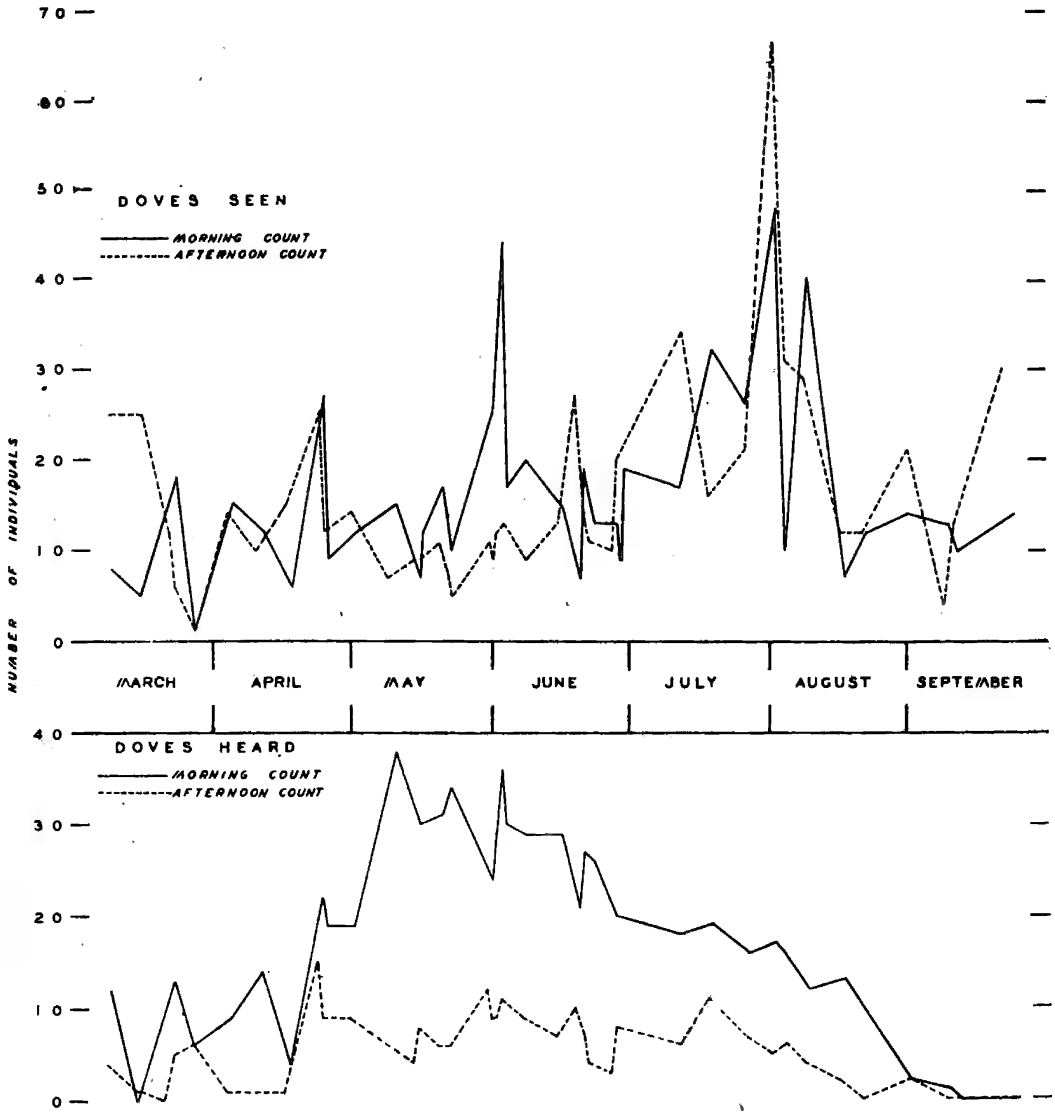

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FIGURE 3. The time factor. Summary of results of 5-crew counts.

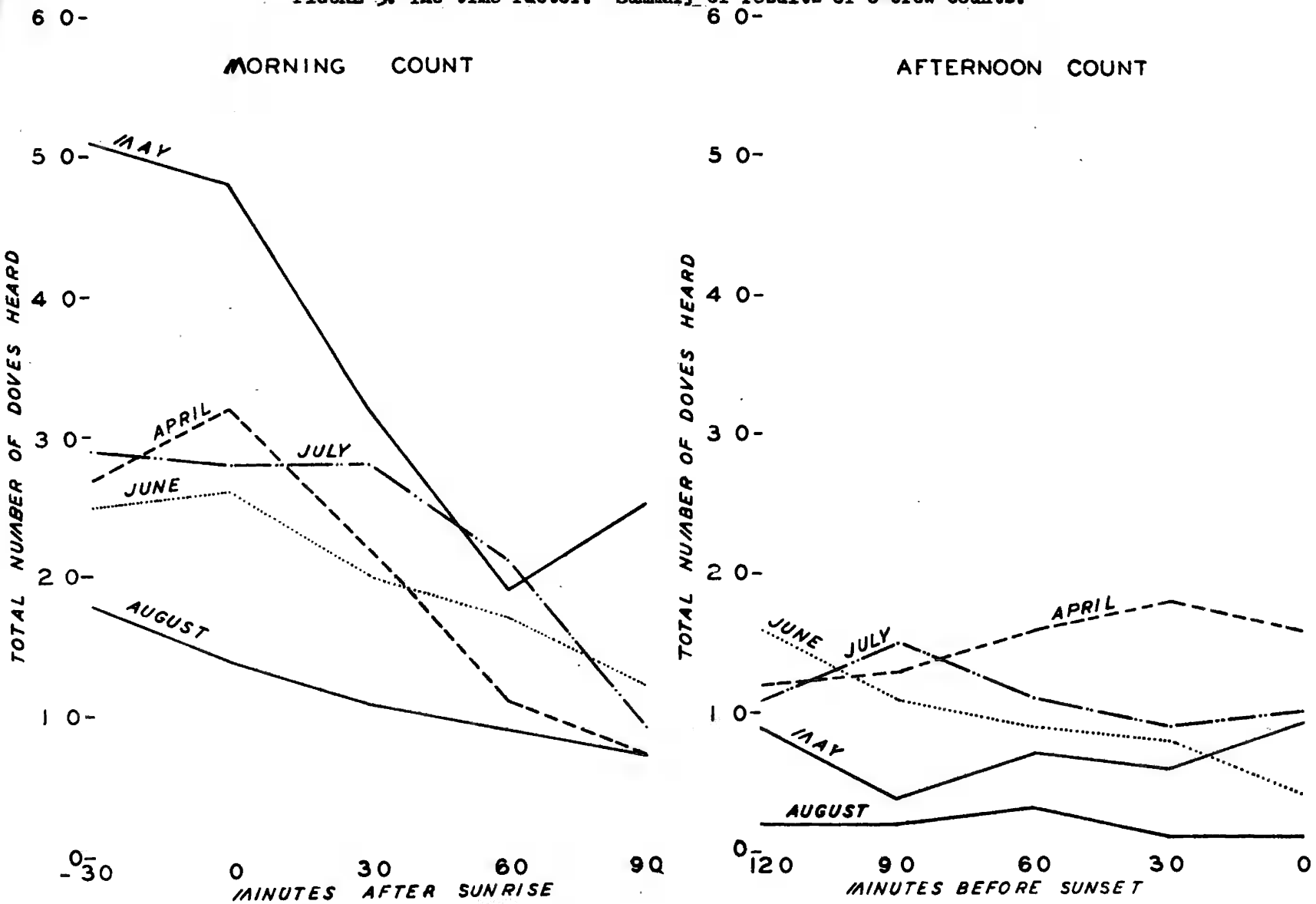

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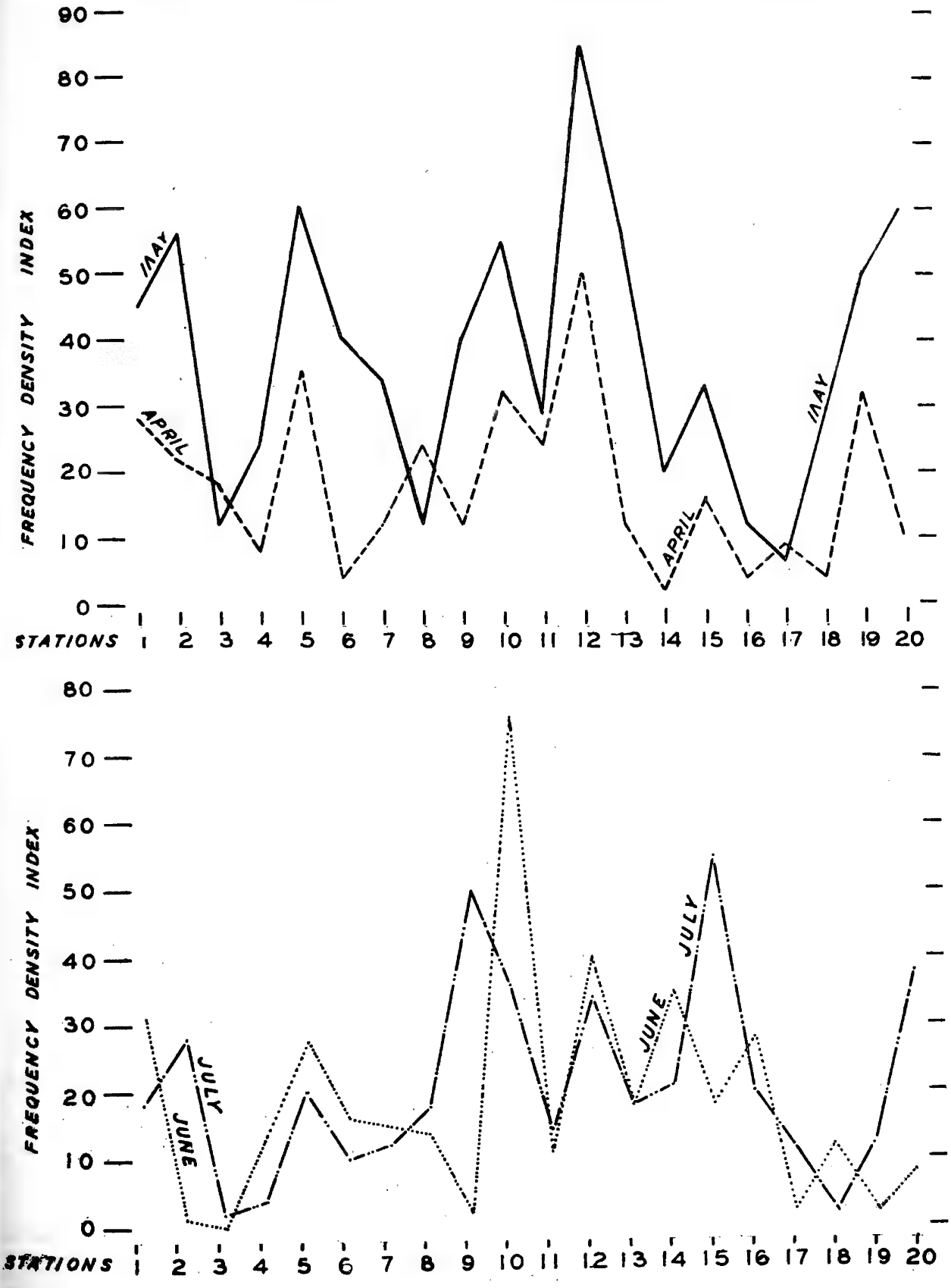
FIGURE 4. Calling activity at stations based upon 5-crew counts.



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in the North and South may not be as different as sometimes supposed. Thus, while the spread of the season is certainly longer in the South, the effective season, when most young are produced, may not be greatly longer in the South. That is, some individual doves may raise more than three broods in the South, but the average may be much less, perhaps similar or even less than that in the North. In a study of ten 100-acre areas in 1951 in various parts of Georgia, Hopkins and Odum found that the production was only 2.1 young fledged per pair, and this low production was not due to unusually high mortality but to the fact that relatively few nests were actually attempted before April or after June.

THE CALL-ROAD COUNT AS AN INDEX TO BREEDING POPULATIONS OF THE MOURNING DOVE IN EAST TENNESSEE *

By Clayton Kerley

Acknowledgment

I should like to express my appreciation to Dr. J. C. Howell for advice and assistance throughout the course of this study; to the staff and students of the Department of Zoology and Entomology and employees of the Tennessee State Game and Fish Commission for their assistance in running the final two-man count; to Mr. Albert E. Hyder of the Federal Aid Section of the Commission for his assistance in obtaining the vehicles and gasoline which were essential in doing the field work involved; to Mr. Will John Cloyd for instruction and assistance in preparing the maps and graphs; to Mr. Arthur Pollard for advice in drawing conclusions from the statistics collected during this course of study; to Dr. A. W. Jones and Dr. James T. Tanner for their critical reading of the manuscript, and to Leonard E. Foote for editing the manuscript for publication.

Introduction

In order to manage the Mourning Dove (Zenaidura macroura L.) as a game bird a practical census method must be found. A yearly production index must be established and used as a guide in setting the bag limit and length of the hunting season (Moore, 1950; Nelson, et al., 1951).

The present study was undertaken at the request of representatives of the U. S. Fish and Wildlife Service, the Wildlife Management Institute, and the Federal Aid Section of the Tennessee State Game and Fish Commission. These agencies wished to compare the data collected in this biological region with the data collected in various other regions throughout the United States.

This study includes the call-road count with a check every other month by a count made by five two-man crews. Added to these counts is an absolute census of the square mile surrounding one of the stations on the route.

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* Contribution from Tennessee Game and Fish Commission and the Department of Zoology and Entomology, University of Tennessee, submitted for partial fulfilment of the requirements for the degree of Master of Science, University of Tennessee.

Materials and Methods

The area chosen for the call-road count is northeast of Knoxville. Its most southwestern point is about seven miles from the city and the most northeastern point is a mile and a half from the Union County line. The twenty-mile course (Figure 1) avoids highways and consists of soil, gravel, and bituminous surfaced roads. The roads chosen do not follow the valleys but instead "take the hills as they come to them." The twenty-mile route lies almost wholly within the forest type known as Yellow Pine-Hardwoods, although in a few places there is a sprinkling of upland hardwoods. About 75 percent of this area is in farms. There is a liberal sprinkling of cedars throughout the entire area. The route crosses no rivers but there are five small streams and many artificial ponds along the twenty-mile course. The average elevation of the area which the route traverses is 1,000 feet above sea level, but at one point it comes within a quarter of a mile of House Mountain the top of which is 2,000 feet above sea level.

The route was laid off according to the suggestions of Foote, 1951. Beginning with station number 1 as the point on the course nearest Knoxville, the stations were numbered clockwise.

Beginning in April, 1951, and ending the following August the course was run one morning and one afternoon a week by the writer. The starting times were one half an hour before sunrise and one hour and a half before sunset. A speed of 25 miles an hour was maintained between stations, hence the entire course was run in two hours. The route was always run in the same direction (Figure 1).

Doves heard calling over the route are shown in Figure 2 on basis of morning versus evening as well as on a monthly basis.

A count by five two-man crews was made in April, June, and August. This five-crew count was made to check the findings of the one-man count that was being run.

An absolute census of the square mile surrounding station number 8 was made during the periods from June 18 to June 22; another absolute census was made from July 19 to July 23, and another from July 31 to August 6 (Figures 3, 4, 5). The square mile consisted of about 70 percent farm land. The remainder of the area supported stands of the Yellow Pine-Hardwood type. There were four artificial ponds and one intermittent stream on this square mile. There was an abundance of cedar trees in all parts of the area. The farms consisted largely of permanent pasture, although there were two grain fields bordering the road to the right and left of the station. Other crops raised were corn and a small amount of tobacco.

Station number 8 was located in the low part of the square mile. Both the northern and southern part of the area were marked by hills which rose about 200 feet above the level of the road. The timber-covered hills to the north of the station were located about one fourth of a mile from the road but the hills to the south, which were in permanent pasture, rose gradually from the side of the road. The road on which this study area was located followed a valley which ran between these two hills in a northeasterly direction.

The absolute census was made by entering the area before sunrise and before sunset and locating the birds by their calls. When a dove called its position was located by the use of field glasses and plotted on a map. Only the doves which called and were found to be established in a certain territory were counted. Doves which were only seen were disregarded. Fortunately in most cases the doves were located far enough apart to avoid counting the same dove twice. By working two hours around sunrise and sunset the whole square mile could be covered in four or five days. Sometimes it was difficult to locate a dove in a thicket even though it would be calling continuously. The most difficult part of the census was to determine the correct number if several doves were calling in the same thicket or grove. In order to make an accurate count the grove would have to be visited several times. The absolute censuses were conducted as close as time allowed to the five crew counts. The one-man call count was run one morning and one afternoon a week while absolute census was being made.

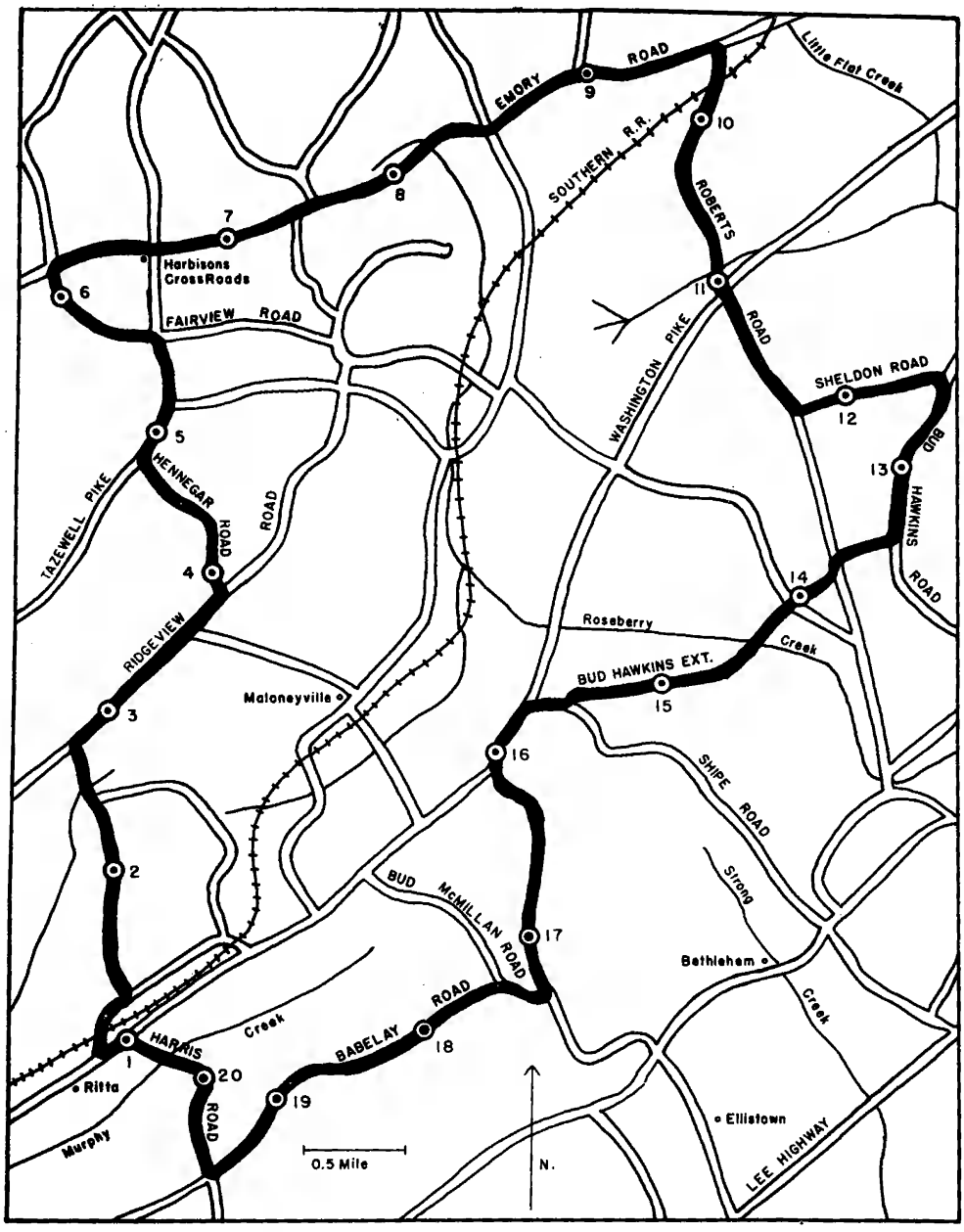
Observations

Foote (in letter) says that 3/8 of a mile is the maximum distance that the cooing call of a dove is ordinarily heard. Therefore, in comparing the number of doves found during the absolute censuses with the averages recorded by the call counts, only those doves are considered which were found within 3/8 of a mile of station number 8.

The average figures used for any station on the route are obtained for the five crew count by dividing the total number of doves heard by the number of persons taking part in the count since each crew member kept separate results. The average figures for the one-man count are obtained by dividing the total number of doves heard at a station during a month by the number of times the station was visited that month.

During the month of April no absolute census was taken at station number 8 but figures are available from the one-man count and the five crew count. The morning count by the five crews gave an average of 2.44 doves while the morning average for the one-man count was 2.00 doves. The evening count was 2.80 doves heard by the five crews and an average of 1.00 dove per trip was heard during the one-man count.

FIGURE I. Road Map. Shows locations of stations on twenty-mile course over which one-man call count and five two-man crew counts were run.



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Public Road

20-mile Route

Listening Station

Village

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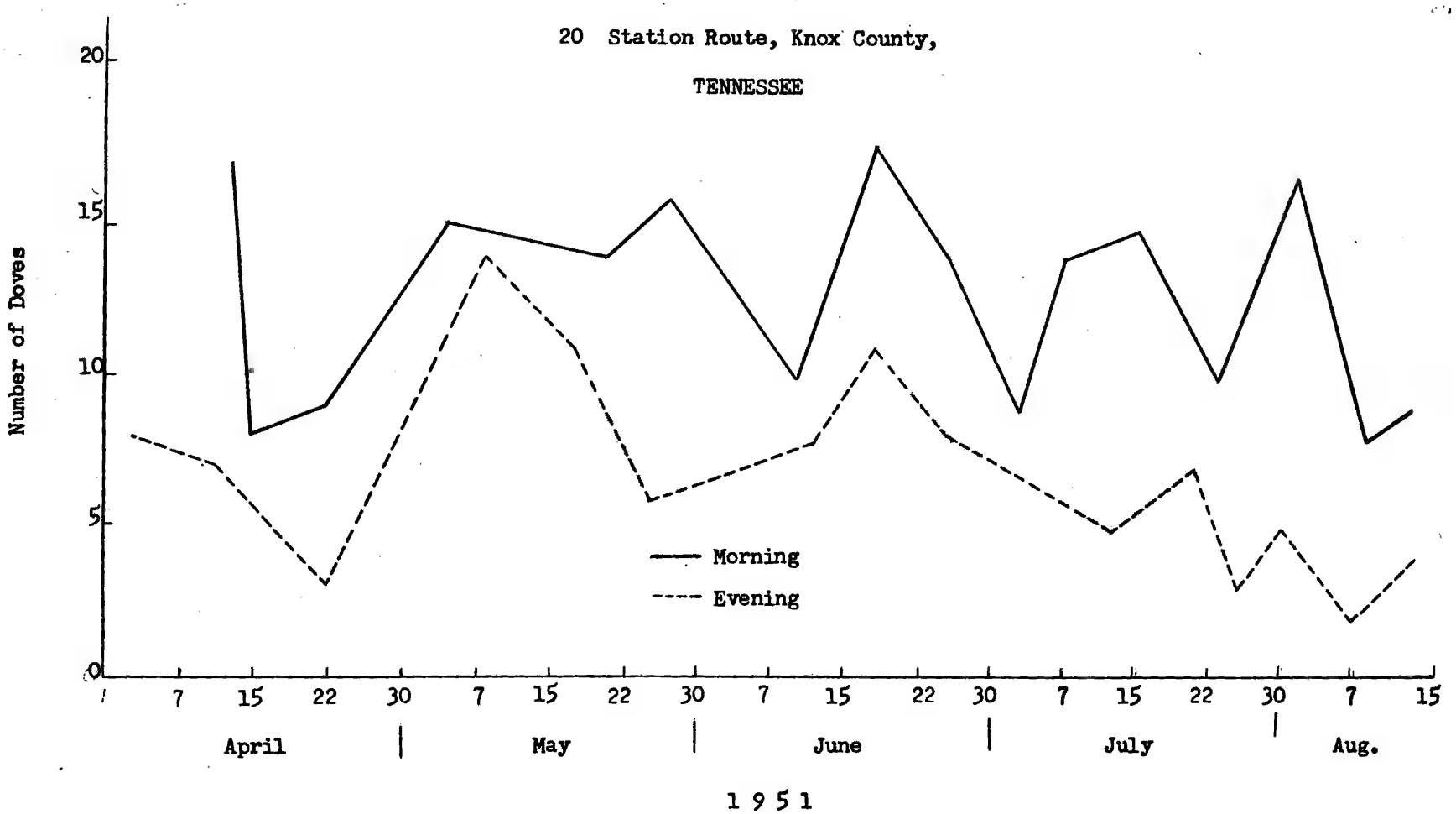
FIGURE 2.

Number of Doves Calling

April - August, 1951

20 Station Route, Knox County,

TENNESSEE



1951

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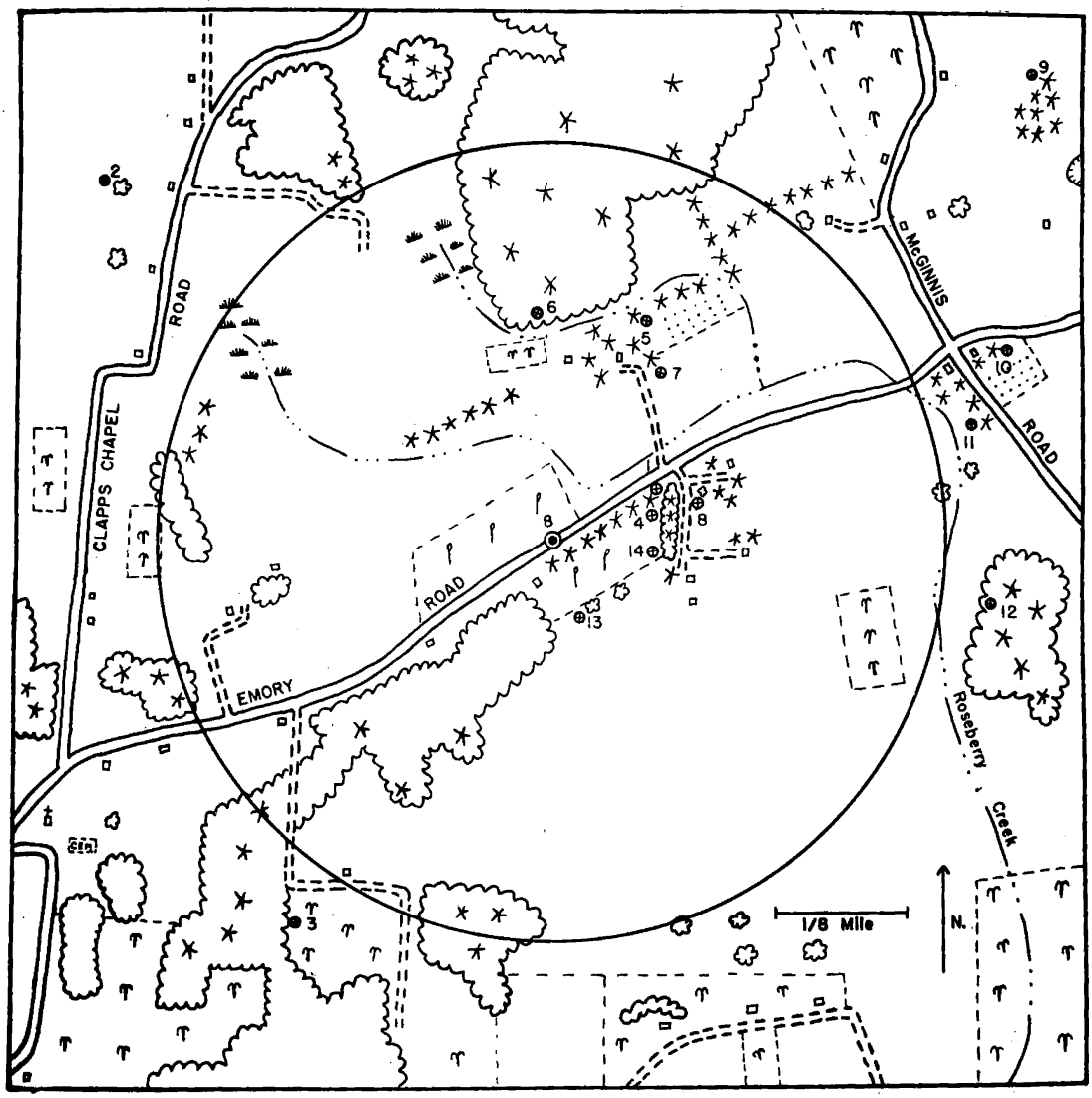
FIGURE 3. Map of Square Mile in June. Map shows area surrounding station number 8 on which absolute census was made during period from June 18 to June 22. Locations of calling doves are marked by a circle containing a cross. Numbers outside circle tell order in which doves were found. Large circle surrounding station 8 has a radius of 3/8 of a mile - the maximum distance within which a dove call is easily heard.



Legend

- Public Road
- Private Road
- Fence Line
- Buildings
- Artificial Pond
- Listening Station
- Doves
- Intermittent Stream
- Marsh or Low Area
- Coniferous Trees
- Deciduous Trees
- Church
- Corn Field
- Grain Field
- Soy Beans
- Permanent Pasture (left blank)

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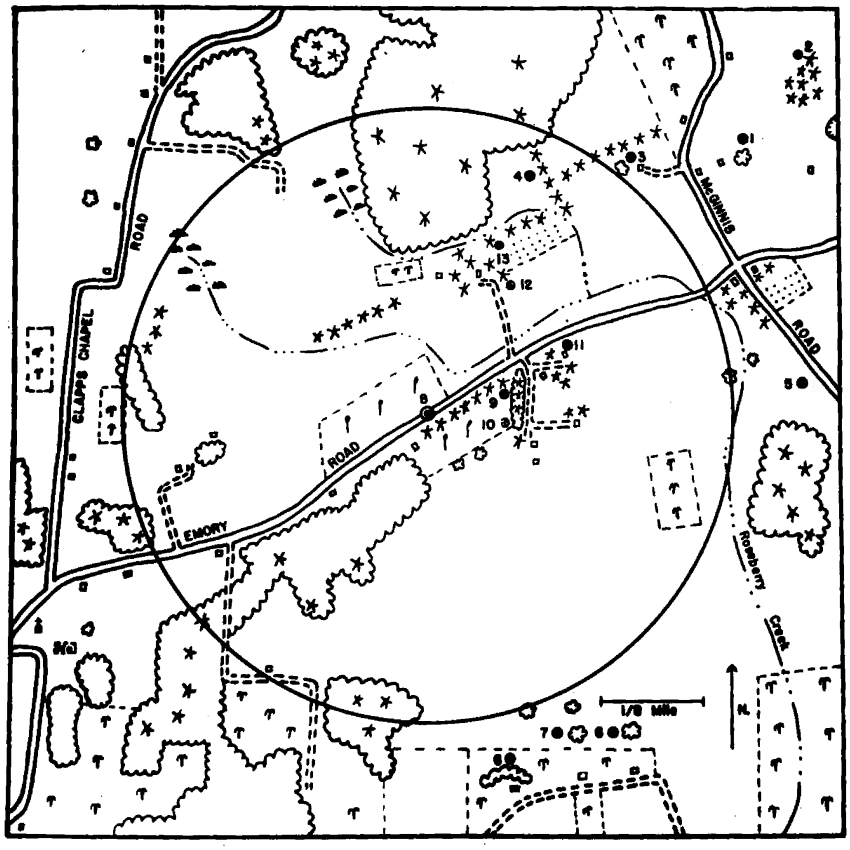
FIGURE 4. Map of Square Mile in July. Map shows area surrounding station number 8 on which absolute census was made during period from July 19 to July 23. See explanation for Figure 3.



Legend

Public Road	Marsh or Low Area
Private Road	Coniferous Trees
Fence Line	Deciduous Trees
Buildings	Church
Artificial Pond	Corn Field
Listening Station	Grain Field
Doves	Soy Beans
Intermittent Stream	Permanent Pasture (left blank)

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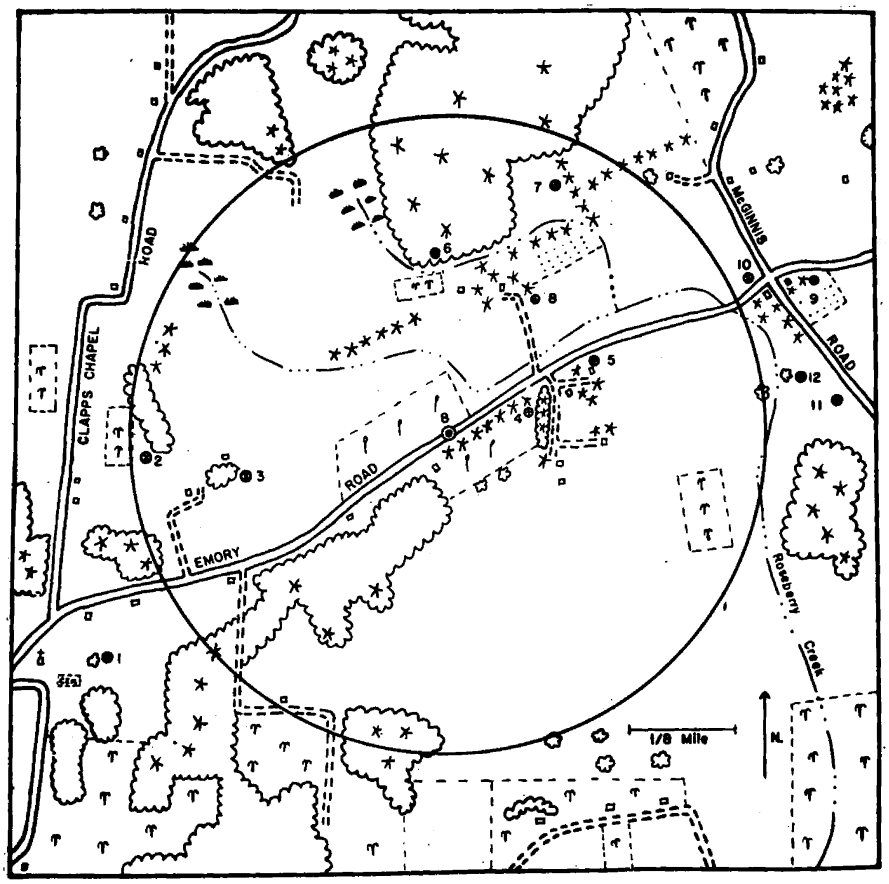
FIGURE 5. Map of Square Mile in August. Map shows area surrounding station number 8 on which absolute census was made during period from July 31 to August 6. See explanation for Figure 3.



Legend

Public Road
Private Road
Fence Line
Buildings
Artificial Pond
Listening Station
Doves
Intermittent Stream
Marsh or Low Area
Coniferous Trees
Deciduous Trees
Church
Corn Field
Grain Field
Soy Beans
Permanent Pasture (left blank)

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An absolute census was made covering the period from June 18 to June 22. Eight calling birds were found within 3/8 of a mile of station number 8 (Figures 6 and 7). The five crews heard an average of 3.25 doves on the morning of June 27 and heard an average of 1.75 doves during the evening count. The one-man call count shows an average for the month of June of 2.00 doves heard in the morning and 1.50 doves heard in the afternoon. The five crews were hearing 41 percent of the calling doves in the morning and 22 percent in the evening that were within 3/8 of a mile of station number 8 according to the absolute census. During the one-man count, 25 percent of the calling doves were heard in the morning and 19 percent in the evening.

No five-crew count was taken in July, but an absolute census was made from July 19 to July 23 to compare with the call count that was being run. There were six calling doves established within 3/8 of a mile of station number 8 at this time. The average number of doves heard in the morning in July during the one-man count was 1.50 or 25 percent of the calling doves present. In the evening 1.25 or 21 percent were heard.

In an absolute census covering the days from July 31 to August 6 seven calling doves were found within 3/8 of a mile of station number 8. The morning count of the five crews on August 9 averaged 1.70 doves or 24 percent of the calling doves present. The average number of doves heard during the one-man count at station number 8 during the month of August in the morning was 2.00 doves or 31 percent of the calling doves present. The afternoon count by the five crews did not occur until August 20 but these crews averaged .80 doves or slightly over 11 percent. No doves were heard during the one-man counts on the afternoons in August.

Although it has been demonstrated that the peak of calling activity in the Mourning Dove is reached at or near sunrise the figures obtained at stations do not depend entirely on such a time factor. At first glance (Figures 8, 9, and 10) it would seem that the high figures obtained at station 8 are due to the fact that the writer, who was running the one-man call count, arrived there at sunrise, or shortly thereafter, and that the low figures obtained at station 19 are due to the late arrival, usually an hour and a half after sunrise. Such is not the case, however, as the average for the five crews follows the same pattern of peaks and depressions on the graph as does the monthly average of the one-man call count. In a five-crew count as many crews would arrive at station number 19 at a favorable time as would arrive at station number 8.

That there are real differences in the calling intensity in relation to sunrise and sunset is apparent from Figure 11. Calling intensity is more uniform over the evening census period, with a decline to almost no activity after sunset.

It was observed while taking the absolute census that in the spring and early summer doves have long periods of continuous calling but in the late summer many doves will call for periods of a few seconds only and then remain quiet for long periods. There were some mornings in August on which no calls at all were heard during the absolute census. However, the very next morning might be marked by a period of intense calling in the very same area. This habit of sporadic calling in August makes it more difficult to take an absolute census as the doves may stop calling before they can be located. Often it was necessary to remain in the same spot for an hour waiting for one of these spells of sporadic calling.

Discussion

A comparison of the one-man call count and the five-crew count over all twenty stations (Figures 8, 9, 10) does not show a very close agreement in the average number of doves heard. Generally speaking the five-crew count and the one-man count agree on the scarcity and abundance of doves at most of the stations. The five crews heard, on the average, more doves than the writer in every count that was made (Table 1).

Table 1.--Average number of doves heard by one-man call count and five two-man crew count by months

	A.M.		P.M.	
	One-Man	Five-Crew	One-Man	Five-Crew
April	11.33	28.77	6.00	16.10
May	15.00	--	10.33	--
June	14.00	27.62	8.50	13.87
July	12.00	--	5.00	--
August	11.33	15.50	3.00	3.10

The evidence shows that the writer, who ran the one-man call count, was well below the average in the perception of dove calls (Figures 8, 9, 10). This inability of the writer may explain why there is a lack of high counts at stations like number 8 in June where there were surely doves to be heard as an examination of the five crew count will show. This lack of acuity of hearing may also explain the blank stations on the route-stations where experienced men in the five two-man crew heard doves consistently.

How can it be explained that the five crews were hearing twice as many doves in April and June as the writer whereas in August they were hearing approximately the same number (Table 1, Figures 8, 9, and 10)? When the doves are numerous or the calling is intense as in April and June the person of low perception finds the doves difficult to separate and may report too few in an effort to keep from over estimating their number. On the other hand when calling is less intense, or is sporadic as in August the person of low perception may be able to count them more easily.

FIGURE 6. Morning Count at Station Number 8. Shows comparison of number of doves found by absolute census with averages heard during five crew counts and one-man count.

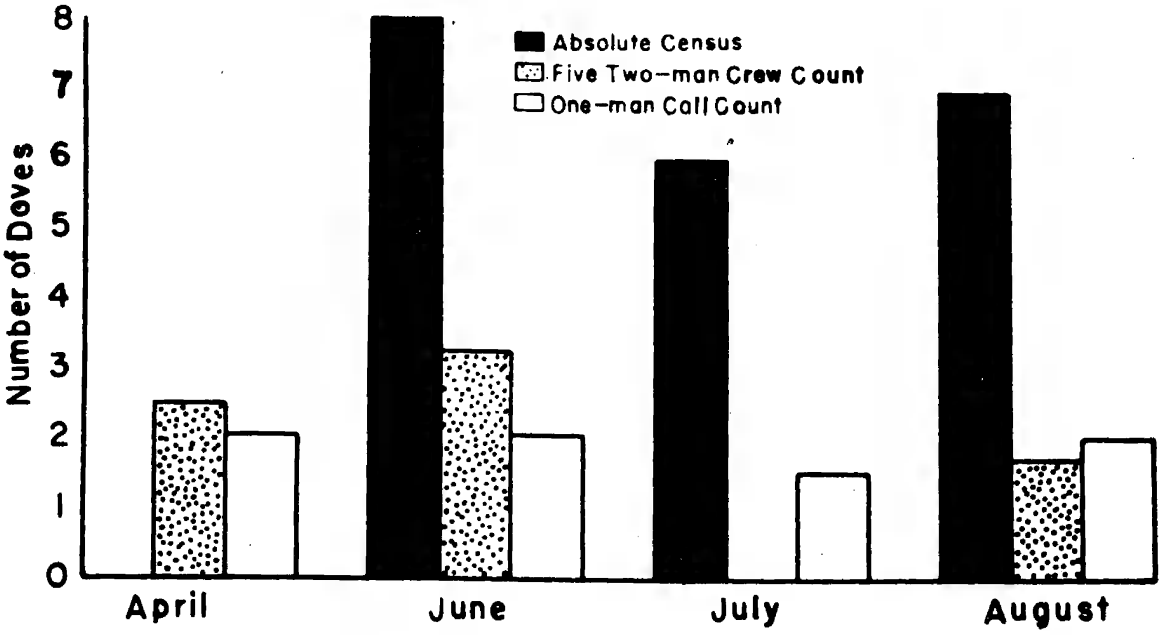
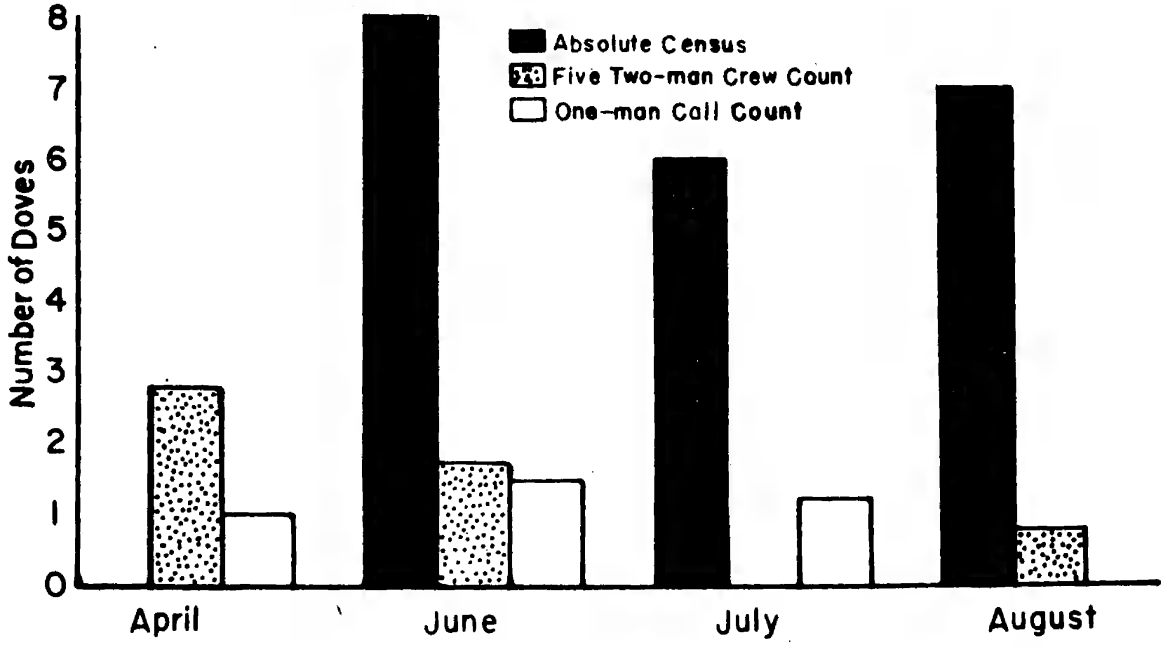


FIGURE 7. Evening Count at Station Number 8.



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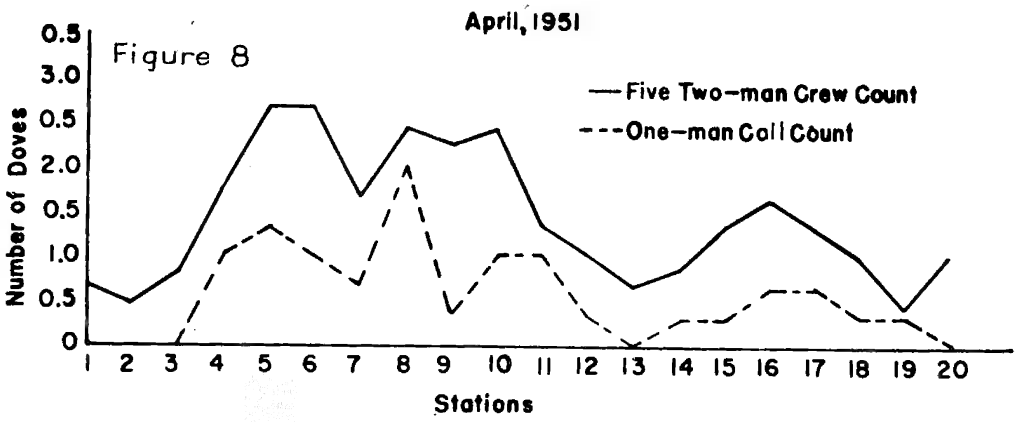
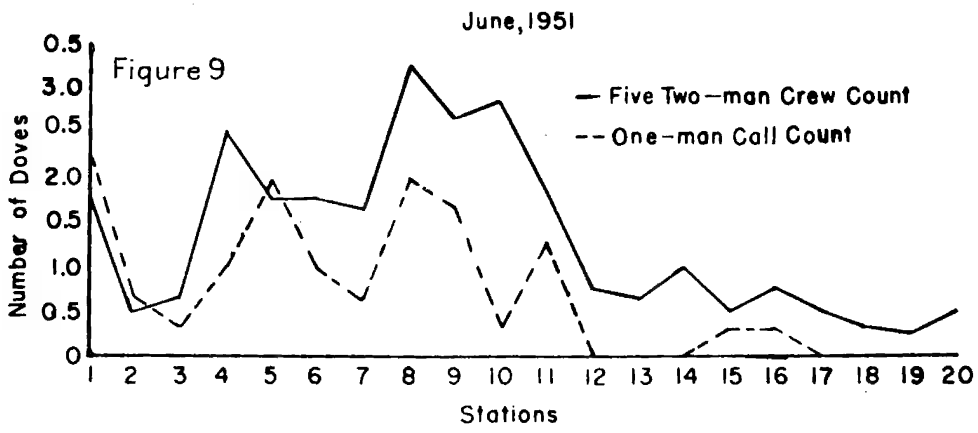
FIGURES 8, 9, and 10. Graphs of all 20 stations. Comparison of average number of doves heard during five crew count and one-man count for mornings of the months of April (Fig. 7), June (Fig.8), and Aug.(Fig.9).





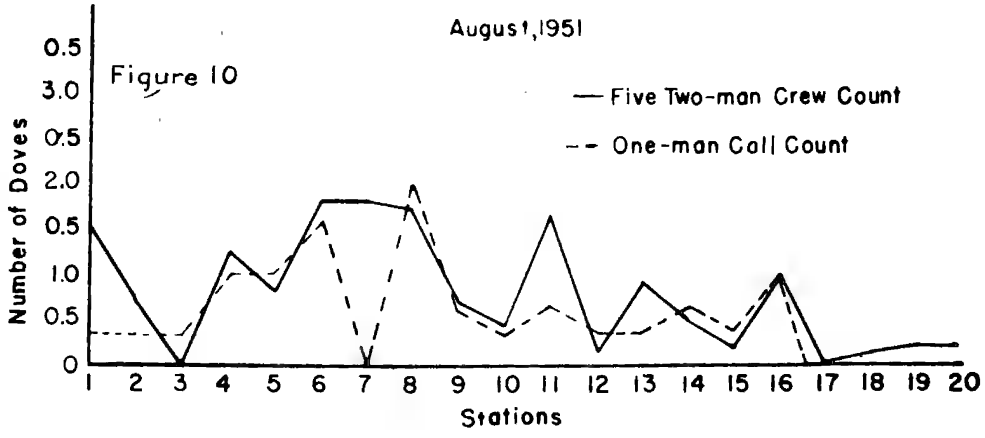


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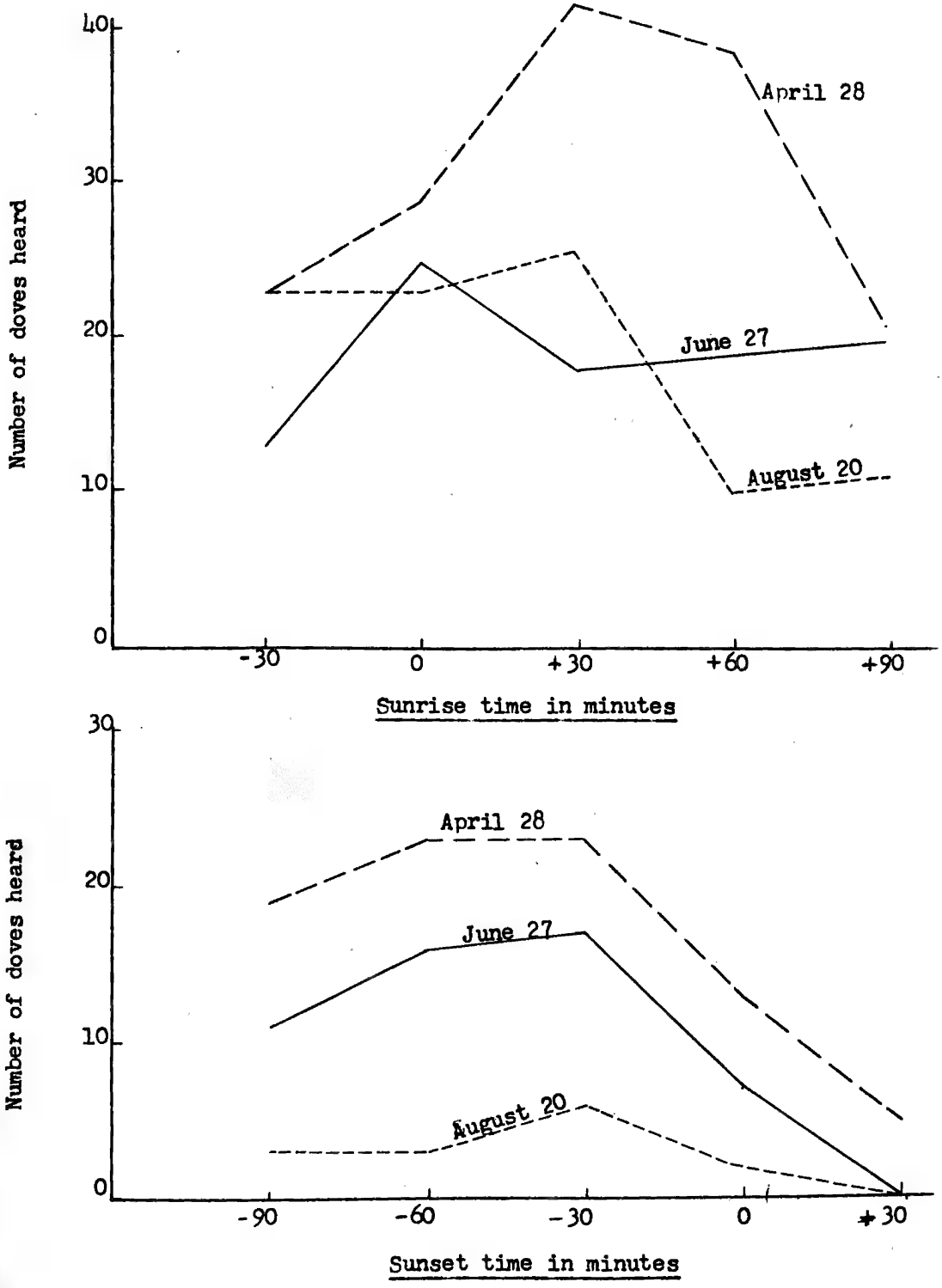
FIGURE 11. Summary of results of 5-crew counts. Plotted to show calling intensity in relation to time. (June counts based on 4-crews only).



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Can it be said that because 25 percent to 31 percent of the doves were being heard during the one-man call count all three times the absolute census was made at station number 8 that the breeding population at every one of the other stations can be estimated by multiplying the average number heard per month by 4? McClure (in letter) warns against giving an area interpretation to calling counts and adds that calling counts are just an indication of abundance from year to year. Foote (in letter) says that it is unimportant to know the total number of doves, that trends may be interpreted from the calling counts.

In the writer's opinion if an attempt is made to evaluate the breeding population of doves from call counts, more stations will have to be censused in the absolute manner, and the results compared with the call count that is then in progress. If an evaluation of the breeding population is made in this manner the percentage established will work only for that one person. It will not apply to the five two-man crew or to another call counter unless his hearing is the same as the person who established the percentage.

Summary

One-man call counts were run one morning and one afternoon a week over a route of twenty stations one mile apart beginning in April and continuing through August in 1951. Five two-man crew counts were run one morning and one afternoon over this same route once during each of the months of April, June and August. Both of these counts were made in accordance with specifications set up under the Cooperative Mourning Dove Project in an attempt to estimate the relative abundance of the breeding population of the Mourning Dove. An effort was made to find what percentage of breeding doves was being herd during the one-man call counts and the five-man call counts by taking an absolute census of the calling birds within 3/8 of a mile of station number 8. These absolute censuses were made during the months of June, July, and August.

There was no close agreement between the average number of doves heard during comparable one-man counts and five-crew counts either at station number 8 or any of the other stations, although the peaks and depressions tend to follow the same pattern (Figures 8, 9, 10). During the five-crew counts the percentage of doves heard on the censused area varied from 41 percent in June to 24 percent in August for the morning counts. A more consistent percentage of the breeding doves present in the area was heard during the one-man counts. These percentages ranged from 25 percent in June and July to 31 percent in August for morning counts.

The writer is of the opinion that several more of the stations on the route would have to be censused before a conclusion could be reached on what percentage of the total number of breeding doves in an area was being heard during a one-man call count. The percentage established would be reliable only for the one person because of the variation in human hearing.

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INVESTIGATIONS OF METHODS OF DETERMINING ABUNDANCE OF BREEDING MOURNING DOVES IN CERTAIN EASTERN STATES

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Plan

Until very recently no satisfactory method was known for evaluating Mourning Dove populations during the nesting season. Therefore in the spring of 1950, the Fish and Wildlife Service directed several of its personnel to investigate methods for obtaining this information.

Our 1950 investigations were pointed toward finding the most practical method from the standpoint of field operations consistent with dove behavior. Efforts in 1951 were directed toward determining the most favorable period during the nesting season of the Mourning Dove to employ the call count method worked out in 1950.

Location

In 1950 field work was conducted in the Hagerstown Valley, Maryland; York and Lancaster Counties, Pennsylvania; the Lake Plains Section of the Central Lowlands physiographic province, from Erie County, Pennsylvania to Rochester, New York; and on eastern Long Island (Suffolk County), New York.

Field work began on May 18 and terminated on June 30, 1950; additional data were gathered that year during two roadside counts and two calling counts in the vicinity of the Patuxent Research Refuge, Laurel, Maryland, in July. In 1951 investigations were conducted in Howard and Prince Georges Counties, Maryland, and in Fairfax County and Alexandria, Virginia, all within a radius of 25 miles of the District of Columbia. The Virginia area is primarily rural residential, in various stages of development, and small farms whereas the two areas in Maryland are principally farmland planted to corn and tobacco, with some extensive pasture. Route #1 (Howard County, Md.) and Route #3 (Alexandria, and Fairfax County, Va.) are in the Piedmont, while Route #2 (Prince Georges County, Md.) is in the Coastal Plain Physiographic Province.

Procedure

Before actual field work was inaugurated in 1950, it was planned to investigate 3 methods. The roadside count had been widely used by wildlife technicians for doves as well as other gamebirds. The spot mapping method had been employed for determining actual numbers of territorial males of numerous species of birds in plots of known size. In the first area visited (Hagerstown Valley, Md.), roadside counts, and area population studies by the spot mapping method were made. Work was continued in southern Pennsylvania (York and Lancaster Counties) with the same two methods employed.

Because of the short time available, the relatively large areas to cover, and the seemingly poor results obtained during the first two weeks, we proceeded to the third method. We began by counting calling doves at regular intervals along the road starting very early in the morning and again in the last three hours before sunset. Roads away from the main traveled highways were selected, and stops were made at every mile. During these stops doves seen were listed as well as those seen while driving between the one-mile stops.

Five minute listening time for each stop was first tried, based in part on H. Elliott McClure's studies in Iowa (Jour. Wildlife Mgt. 1939, 3: 323-328). One mile intervals between stops were tested to avoid possible duplication of calling birds.

According to previous arrangement Harold Peters met with Duvall and Robbins in Erie, Pa., June 6-8, and joined in making morning and evening call counts. It was then agreed that the three would concentrate on this method during the remainder of this particular investigation.

Active field studies in 1951 began on April 5 and were terminated on September 11 insofar as the call counts were concerned. A standardized procedure of 20 stops of 3 minutes duration decided upon by agreement with several other investigators, was adopted; starting time was 1/2 hour before local official sunrise. Counts were made by three observers on three separate routes on the same day of each week, except the first one. Call count studies on area #3 were terminated after June 26.

Roadside counts were begun on the census transects on July 27 and usually conducted by the three observers thereafter on the Monday evening preceding the regular Tuesday call count. After completion of the call counts on September 11, morning roadside counts were made over the same routes starting on September 18.

Route #1 was censused by Chandler S. Robbins, Route #2 by Allen J. Duvall, and Route #3 by John W. Aldrich.

It can be seen from the description of the call count procedure that this technique combines features of several methods. The spotting of singing birds is one of the most widely accepted methods used in making area population studies; and the numbers of birds seen driving between the call-counting stations is nothing more than a "roadside count" made in conjunction with the "call run." Birds flushed by the car when a call count stop was made, or birds seen during a stop to count calling doves, were birds which would not have been observed during a pure roadside count. Thus all of the methods tested supplied information of value in testing the practicality of the various steps developed in the call count method.

Observations

Roadside Counts.--In 1950 counts were divided into three categories (Table 1) because of the marked difference in the type of routes traveled, and because of the particular time of day. In some instances well-traveled highways were covered; while in others county roads and routes with no appreciable traffic were traversed. Category (c) contains birds recorded the first four hours after sunrise over roads equivalent to category (b). The data for category (c) were obtained in connection with calling counts which will be discussed later.

From Table 1, it can be seen that observations made on roads away from heavily used highways give counts $5\frac{1}{2}$ times as high as those along heavily traveled routes. Likewise roadside counts made during the first four hours after sunrise produced $2\frac{1}{2}$ times as many birds as counts made later in the day.

In 1951 a comparison of doves heard with doves seen during the weekly calling counts (Figure 1) indicates that doves were relatively inconspicuous during that part of the nesting season up to about the 10th of July. After that date doves became increasingly more in evidence and eventually many more were seen than were heard.

During the weekly calling counts, doves which were seen at stops were separated into those which would have been observed even if the car had not stopped (Table 2) and into those which would not have been observed (included in trip totals in Table 3). Relatively little difference was noted between these categories until about mid-June (Figure 2) which preceded the period when more doves were seen than were heard (Figure 1). An illustration of the difference in the categories mentioned above is shown by the fact that on September 11, 41 doves were actually seen by one observer, while only 4 of this number would have been recorded if he had not stopped. Again on August 7, only 12 of 37 doves seen would have been recorded on a non-stop roadside count.

Table 1.--Comparison of Three Types of Roadside Counts (1950)

Locality	a. Heavily Traveled Routes All Daylight Hours			b. Lightly Traveled Routes All Daylight Hours except first 4 after Sunrise			c. Lightly Traveled Routes First 4 Hours after Sunrise		
	Birds	Miles	Birds per 100 Miles	Birds	Miles	Birds per 100 Miles	Birds	Miles	Birds per 100 Miles
Western Maryland	2	41	5	31	153	20	10	62	16
Southern Pennsylvania	9	292	3	33	408	8	39	156	25
Western New York	3	456	1	73	705	10	39	144	27
Long Island	3	200	1.5	9	267	3	14	66	21
N.W.Pennsylvania	----------		insufficient data	----------			39	147	27
Average			1.72			9.52			24.5

FIGURE 1. Average number of CALLING DOVES per weekly trip (2) compared with average number of DOVES SEEN. 1951

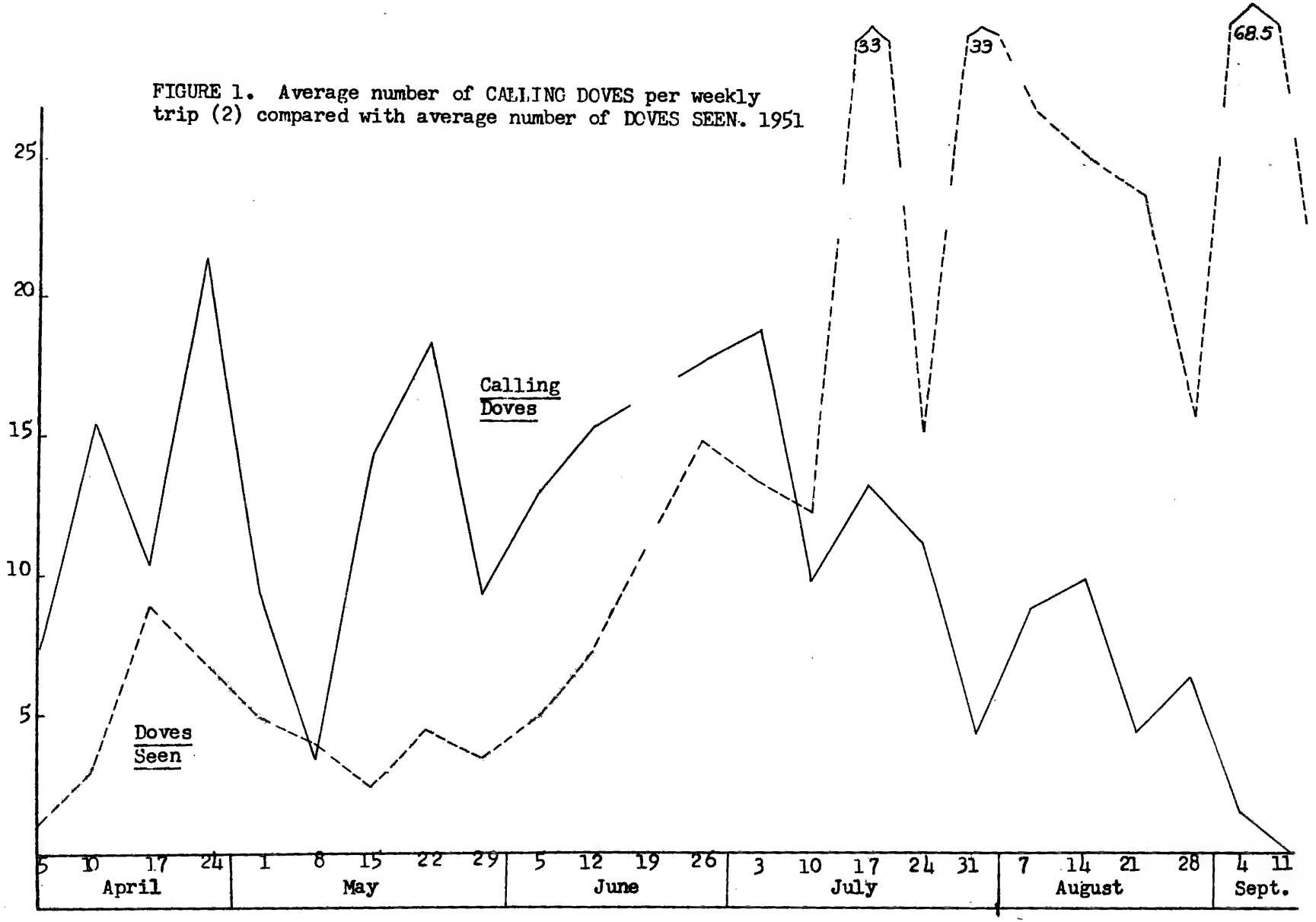

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Table 2.--Total Doves Seen Driving During Calling Counts (1951)

Date	Route 1	Route 2	Route 3	2 Routes		3 Routes	
				Total	Av.	Total	Av.
4/5	1	0	1	1	0.5	2	0.7
4/10	1	4	1	5	2.5	6	2.0
4/17	6	4	3	10	5.	13	4.3
4/24	2	9	(3)	11	5.5	(14)	(4.7)
5/1	5	3	4	8	4.	12	4.0
5/8	2	2	3	4	2.	7	2.3
5/15	1	1	6	2	1.	8	2.7
5/22	4	4	2	8	4.	10	3.3
5/29	6	1	5	7	3.5	12	4.0
6/5	4	6	8	10	5.	18	6.0
6/12	1	4	13	5	2.5	18	6.0
6/19	no trip	8	5	(8)	(8.0)	(13)	(6.5)
6/26	8	19	15	27	13.5	42	14.0
7/3	10	8		18	9.0		
7/10	7	12		19	9.5		
7/17	15	35		50	25.0		
7/24	11	16		27	13.5		
7/31	46	14		60	30.0		
8/7	10	12		22	11.0		
8/14	23	15		38	19.0		
8/21	20	16		36	18.0		
8/28	16	0		16	8.0		
9/4	25	85		110	55.0		
9/11	4	3		7	3.5		
Total	228	281	69	509		175	

Table 3.--Total Doves Seen During Calling Counts (1951)

Date	Route 1	Route 2	Route 3	2 Routes		3 Routes	
				Total	Av.	Total	Av.
4/5	1	1	1	2	1.0	3	1.0
4/10	1	5	1	6	3.0	7	2.3
4/17	6	12	3	18	9.0	21	7.0
4/24	3	11	(3)	14	7.0	(17)	(5.7)
5/1	7	3	4	10	5.0	14	4.7
5/8	6	2	3	8	4.0	11	3.7
5/15	3	2	6	5	2.5	11	3.7
5/22	5	4	2	9	4.5	11	3.7
5/29	6	1	6	7	3.5	13	4.3
6/5	4	6	8	10	5.0	18	6.0
6/12	11	4	13	15	7.5	28	9.3
6/19	no trip	18	5	(18)	(9.0)	(23)	(11.5)
6/26	8	23	15	31	15.5	46	15.3
7/3	12	15		27	13.5		
7/10	7	18		25	12.5		
7/17	22	44		66	33.0		
7/24	11	20		31	15.5		
7/31	46	20		66	33.0		
8/7	17	37		54	27.0		
8/14	24	27		51	25.5		
8/21	21	27		48	24.0		
8/28	32	0		32	16.0		
9/4	52	85		137	68.5		
9/11	41	5		46	23.0		
Totals	346	390	70	736		223	

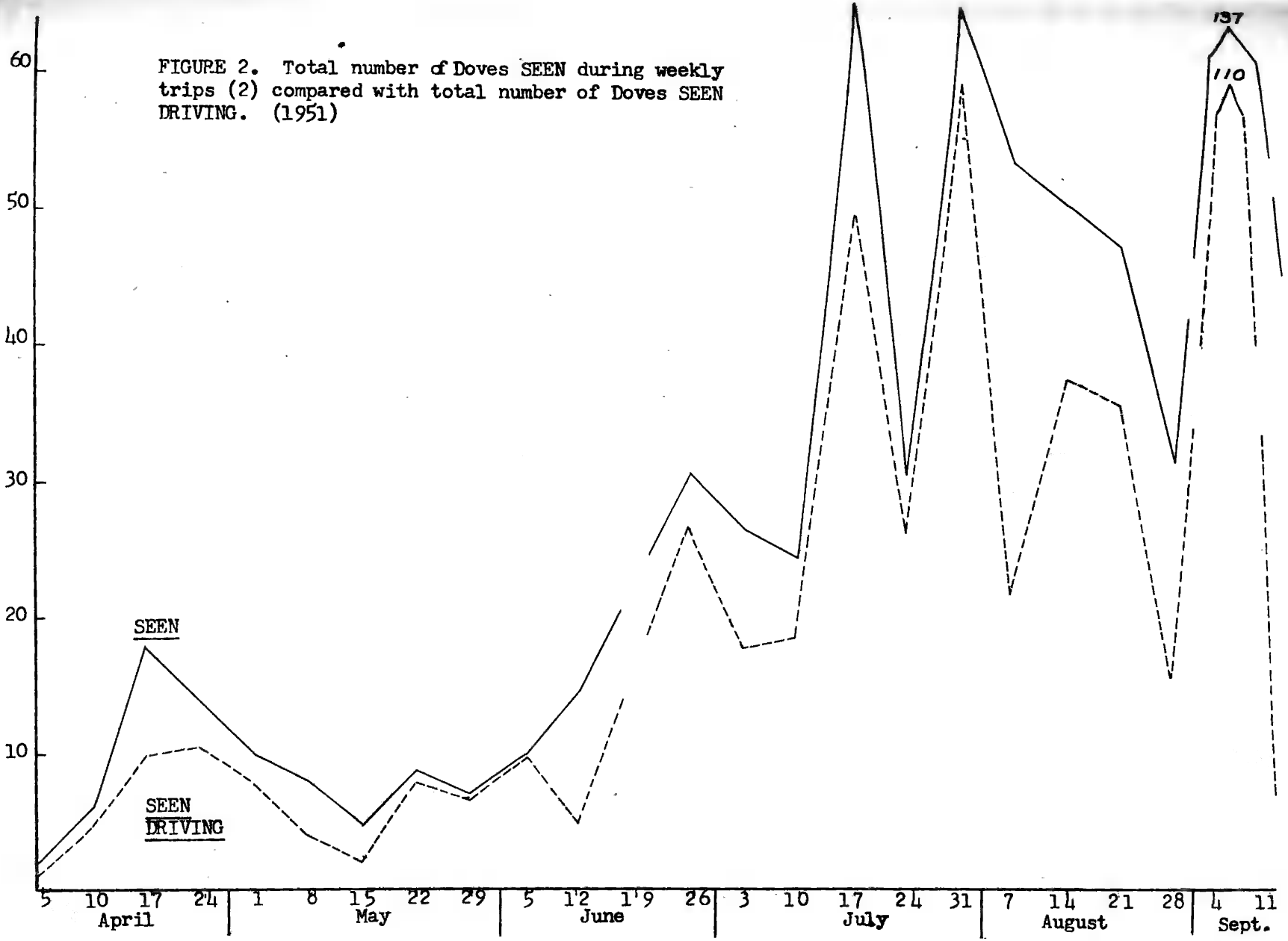
FIGURE 2. Total number of Doves SEEN during weekly trips (2) compared with total number of Doves SEEN DRIVING. (1951)
137
110
60
50
40
30
20
10
SEEN
SEEN DRIVING
5 10 17 24 April
1 8 15 22 29 May
5 12 19 26 June
3 10 17 24 31 July
7 14 21 28 August
4 11 Sept.

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A 4-months tabulation of doves seen during morning roadside counts (July through October) over 2 routes in Maryland, indicates that there was a general build-up through September, with a decline during the month of October (Table 4).

Table 4.--Morning Roadside Counts of Routes #1 and #2 (1951)

July	August	September	October
18	22	110	12
19	38	7	1
50	36	114	9
27	16	34	2
60			0
Av. 34.8	Av. 28.0	Av. 66.3	Av. 5.0

Roadside counts were conducted in the evening over the calling count routes with weekly trips from the last day of July through October. In an attempt to evaluate the best time of day to conduct such counts, roadside count data obtained during the regular weekly calling counts were used, together with the roadside counts made in the early morning after call counts were discontinued (Sept. 11). Counts over Route #1 (Table 5) indicate that the number of doves seen during the morning was much higher than in the evening. On the other hand, Routes #2 and #3 show very little difference between the two times of day. Thus, it is apparent that no conclusions can be drawn regarding the preference of morning versus evening until more data are available.

Table 5.--Roadside Counts Over 20-mile Calling Count Routes

Date	Morning Route 1	Morning Route 2	Morning Route 3	Evening Route 1	Evening Route 2	Evening Route 3	Date
7/31	46	14	4	-	11	12	7/27
8/7	10	12	-	6	14	16	8/6
8/14	23	15	-	16	17	9	8/13
8/21	20	16	-	9	8	5	8/20
8/28	16	0	-	23	8	7	8/27
9/4	25	85	-	15	5	4	9/3
9/11	4	3	-	6	23	-	9/10
9/18	113	1	4	3	3	12	9/17
9/25	29	5	3	-	11	7	9/24
10/2	10	2	22	2	2	1	10/1
10/9	1	0	-	4	0	-	10/8
10/16	8	1	-	7	13	0	10/15
10/23	0	2	-	4	20	-	10/23
10/30	0	0	0	0	0	7	10/30
Total	305	156	33	95	132	80	

Av. Route #1 (A.M. & P.M.)	15.4 doves
Av. Route #2 "	10.3 "
Av. Route #3 "	7.1 "
Av. Routes #1 & #2 (A.M.)	16.5 "
Av. " " " (P.M.)	8.7 "
Av. " (#1,2,3) (A.M.)	15.0 "
Av. " " (P.M.)	8.3 "

Table 6 shows the number of doves seen and heard during call counts in 1950. A distinction has been made between birds seen while driving between the one-mile stops and those actually seen (and not heard) during the 3-minute listening periods. It is believed that birds under the column "doves seen driving" are comparable with data from early morning roadside counts whereas birds recorded under "doves seen stopped" include only those individuals which would not have been recorded had the car been in motion. Of the 338 doves seen during these call counts, 184 or 54 percent of the birds were seen while stopped.

An interesting comparison can be made between birds recorded on calling counts and those recorded during pure roadside counts. From Table 6, let us consider only the figures for pre-sunrise through the third hour for comparison with roadside data from part "b" of Table 1. All call count data for these "four" hours average 111 doves per 100 miles as opposed to an average of only 9½ doves per 100 miles during roadside counts (Table 1). If consideration is made for the fact that it takes three times as long to cover the same distance in making call counts, a factor of three should be applied to the figure "9½." The latter figure (9½) then would be 28½ doves per 100 miles on roadside counts as compared with 111 per 100 miles recorded during call counts. If an additional factor of 2½ is introduced to compensate for the time of day when roadside counts were made we have, then, an average of 71 doves per 100 miles; this is still only 64 percent of the average figure for call counts (see page 17 for explanation of factor of 2½). These data show that call counts plus the doves seen during these counts give far more information on abundance of doves during the breeding season than roadside counts alone, even when all possible allowances are made in computing roadside counts.

During the morning period (through third hour after sunrise) when call counts were made in 1950, 686 doves were recorded: 80 percent were tabulated at one-mile stops and the remainder while driving from one stop to another. Even if an allowance (factor of 3) is made for the time element for birds seen while driving, the total number of birds recorded while stopped would still be far in excess of those seen while driving. For all the major areas studied there was an average of 111 doves per 100 miles traveled, 64 doves per 100 miles being calling individuals.

Table 6.--Doves Recorded During Call Counts (1950)

Locality	Time of Day	No. of Stops	No. Doves Calling	Doves Seen Stopped	Doves Seen Driving	Total Doves per 100 Miles
York and Lancaster Counties, Pa.	Pre-sunrise	13	13	2	5	154
	1st hr.after	31	36	16	11	203
	2nd hr. "	44	13	10	12	80
	3rd hr. "	46	15	14	6	76
	4th hr. "	35	4	14	10	80
	5th hr. "	20	5	2	3	50
	6th hr. "	13	3	3	4	77
Erie County, Pa.	Pre-sunrise	6	2	4	0	100
	1st hr.after	52	44	16	17	148
	2nd hr. "	50	17	21	17	110
	3rd hr. "	35	6	6	5	49
	4th hr. "	10	1	7	0	80
Western New York	Pre-sunrise	35	78	1	1	103
	1st hr.after	61	73	13	21	176
	2nd hr. "	44	27	14	7	109
	3rd hr. "	29	14	15	9	131
	4th hr. "	10	0	1	2	30
Suffolk County, L. I.	Pre-sunrise	21	8	3	0	52
	1st hr.after	27	16	0	7	85
	2nd hr. "	29	3	7	6	55
	3rd hr. "	10	0	0	1	10
Maryland	Pre-sunrise	24	13	1	0	58
	1st hr.after	38	14	3	7	63
	2nd hr. "	24	2	11	3	67
Total		707	407	184	154	105

Area Population Studies.--Population studies based on repeated censuses and searches for nests were conducted in seven (7) study areas of three different types. Table 7 gives a summary of doves found in each study plot and the total man-hours required to obtain these data for each area.

Abandoned apple orchards were first selected but the results from the two areas in Maryland and Pennsylvania seemed so poor that other habitats were chosen for most of the subsequent studies. Results from rural cemeteries gave better data and in much less time. Furthermore, the finding of nests was easier in cemeteries because of the relatively small number of trees that were suitable for nesting sites. In an orchard of 125 acres there normally are 1,000 or more mature trees which are potential nesting sites. Obviously much time would be required to examine each tree for nests. The average density in the three cemeteries was 54 pairs of doves per 100 acres while it was only 2½ pairs per 100 acres in three abandoned apple orchards. Not only was the actual density much greater in rural cemeteries but, as stated above, nests were much more readily found, and census work was completed in much less time.

The only sample of a suburban residential study area also was much more productive than apple orchards as far as dove populations were concerned, but nests were difficult to locate.

Call Counts.--Tables 8 and 9 present the data on the number of calling birds and the number of times each bird called during a 3-minute period in 1950. They have been arranged according to localities and time of day with respect to official sunrise. They indicate that there was a definite regularity in the decrease in the number of calling birds as the day progressed and a noticeable irregularity in the number of times each bird called in the 3-minute periods.

The largest number of pre-sunrise samples was obtained in western New York under optimum conditions; these data indicate then, that more doves were calling in the period (1/2 - 3/4 hour) before sunrise than during any other observation period. The relatively high counts in the first hour after sunrise in York, Lancaster, and Erie Counties, Pennsylvania, are more in line with observations made in 1951 in Maryland and Virginia. In the case of Long Island, the small number of samples, together with unfavorable habitats visited before sunrise seemed to be the factors contributing to a low count in the pre-sunrise period.

Table 7.--Area Population Studies (1950)

Location	Size in Acres	Pairs of Doves	Active Nests Examined	Pairs Doves per 100 Acres	No. Census Trips	Total Man-hours per Area
(a) Abandoned Apple Orchards						
Strong's Orchard Md.: Washington County Clear Sp.	125	3	1	2.4	9	21
Myers' Orchard Pa.: York County Paradise Twp.	9.5	0	0	0	5	4.5
Group's Orchard N.Y.: Niagara County Model City	58	2	0	3.5	5	5
(b) Suburban Residential Area						
Pa.: East York	121	11	1	9.1	14	10.5
(c) Rural Cemeteries						
Girard Cemetery Pa.: Erie County Girard	9.5	4	3	42	4	7
Wrightsville Cemetery Pa.: York County Wrightsville	9	4	3	44	2	2.5
Greenwood Cemetery N.Y.: Niagara County Wilson	9.6	7	6	73	6	9.5

Table 8.--Call Counts Compared on Basis of Number of Calls and Actual Number of Birds Calling (1950)

Locality	Time of Day With Respect to Sunrise	No. of Stops	No. Doves Calling	Doves Calling per 100 Stops	Total Calls	Av. Calls Per Bird
York and Lancaster Counties, Pa.	Pre-sunrise	13	13	100	64	4.92
	1st hr. after	31	36	116	144	4.00
	2nd hr. "	44	13	30	58	4.46
	3rd hr. "	46	15	33	63	4.20
	4th hr. "	35	4	11	13	3.25
	5th hr. "	20	5	25	14	2.80
	6th hr. "	13	3	23	15	5.00
Erie County, Pa.	Pre-sunrise	6	2	33	12	6.00
	1st hr. after	52	44	85	172	3.91
	2nd hr. "	50	17	34	64	3.76
	3rd hr. "	35	6	17	34	5.67
	4th hr. "	10	1	10	2	2.00
Western New York	Pre-sunrise	35	78	222	492	6.30
	1st hr. after	61	73	120	329	4.50
	2nd hr. "	44	27	61	94	3.48
	3rd hr. "	29	14	48	84	6.00
	4th hr. "	10	0	0	0	0
Suffolk County L. I.	Pre-sunrise	21	8	38	54	6.75
	1st hr. after	27	16	59	94	5.88
	2nd hr. "	29	3	10	11	3.67
	3rd hr. "	10	0	0	0	0
Hagerstown Valley and Patuxent Refuge, Md.	Pre-sunrise	24	13	54	69	5.30
	1st hr. after	38	14	37	70	5.00
	2nd hr. "	24	2	8	5	2.50

Table 9.--Call Counts Compared on Basis of Time of Day and Locality (1950)

Locality	No. of Stops	No. Doves Calling	Doves Calling per 100 Stops	Total Calls	Av. Calls per Bird
			Pre-sunrise		
York and Lancaster Counties, Pa.	13	13	100	64	4.92
Erie County, Pa.	6	2	33	12	6.00
Western New York	35	78	222	492	6.30
Suffolk County, L. I.	21	8	38	54	6.75
Maryland	24	13	54	69	5.30
Total	99	114	115	691	6.06
			1st. Hour after Sunrise		
York and Lancaster Counties, Pa.	31	36	116	144	4.00
Erie County, Pa.	52	44	85	172	3.91
Western New York	61	73	120	329	4.50
Suffolk County, L. I.	27	16	59	94	5.88
Maryland	38	14	37	70	5.00
Total	209	183	88	809	4.42
			2nd Hour after Sunrise		
York and Lancaster Counties, Pa.	44	13	30	58	4.46
Erie County, Pa.	50	17	34	64	3.76
Western New York	44	27	61	94	3.48
Suffolk County, L. I.	29	3	10	11	3.67
Maryland	24	2	8	5	2.50
Total	191	62	32	232	3.74
			3rd Hour after Sunrise		
York and Lancaster Counties, Pa.	46	15	33	63	4.20
Erie County, Pa.	35	6	17	34	5.67
Western New York	29	14	48	84	6.00
Suffolk County, L. I.	10	0	0	0	0
Total	120	35	29	181	5.17
			4th Hour after Sunrise		
York and Lancaster Counties, Pa.	35	4	11	13	3.25
Erie County, Pa.	10	1	10	2	2.00
Western New York	10	0	0	0	0
Total	55	5	9	15	3.00

In the afternoon or evening the best time for calling seemed to be the two hours preceding official sunset. In the York-Lancaster region and in Erie County, Pa., both areas (1950) averaged 20 calling birds per 100 stops (based on 80 samples) in the last two hours before sunset. On the other hand, counts made during the first two hours after sunrise in these same areas yielded 65 birds and 60 birds per 100 stops, respectively (based on 177 samples). It can be seen that, in these areas, morning counts were at least three times more productive of calling birds than evening counts.

In the 1951 counts in Maryland and Virginia we were indeed fortunate that no censuses were postponed because of such adverse weather factors as wind and rain, although on May 8 wind could have been responsible for the low counts. Starting temperatures ranged from 32 degrees on April 5 and 22, to the mid-seventies on July 24 and August 21. Cold weather, as such, had no apparent effect on calling activities since several of the highest weekly counts were recorded during the coldest mornings. The warmest weather, of course, was during July and August, but the decline in calling activities during these months is probably not associated with the seasonal temperature increase, but rather with the decline in breeding activity.

Calling activities during the 1951 nesting season showed relatively high peaks and low depressions during April and May, and a plateau in the month of June (Figure 3). The average number of calling doves for May was smaller than either April or June as shown in Table 10, and with little difference between these latter months. A drop is noticed after the July 3 census and the noticeable decrease in calling activities continued until September 11 when no doves were recorded calling. Data showing the actual number of doves calling on each weekly trip are given in Table 11.

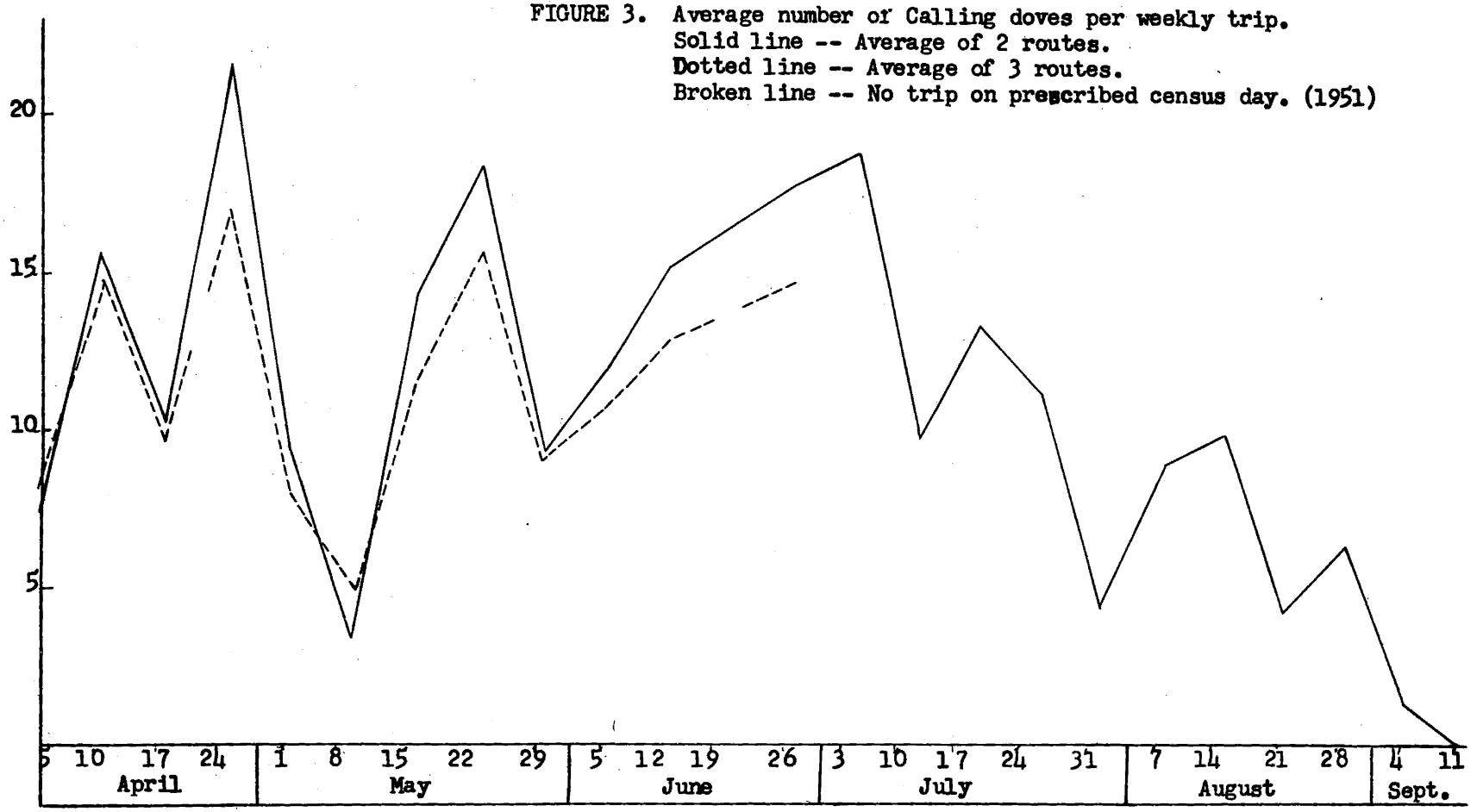
Table 10.--Calling Doves by Months and Routes

Months	Route 1	Route 2	Route 3	Total	Trips per month	Average per trip
April	63	47	30	140	11	(12.7)
May	68	43	38	149	15	(9.9)
June	59	50	32	141	11	(12.8)
July	82	35	-	120	10	(12.0)
Aug.	37	23	-	60	8	(7.5)
Sept.	0	3	-	3	4	(0.75)

Table 11.--Calling Doves per Weekly Trip

Date	Route 1	Route 2	Route 3	Total 3 Routes	Total Routes #1 & #2	Average 3 Routes	Average Routes #1 & #2
4/5	14	1	9	24	15	8.0	7.5
4/10	15	16	13	44	31	14.7	15.5
4/17	12	9	8	29	21	9.7	10.5
4/24	22	21	[8]	[51]	43	[17.0]	21.5
5/1	10	9	5	24	19	8.0	9.5
5/8	5	2	8	15	7	5.0	3.5
5/15	17	12	6	35	29	11.7	14.5
5/22	20	17	10	47	37	15.7	18.5
5/29	16	3	9	28	19	9.3	9.5
6/5	18	8	9	35	26	11.7	13.0
6/12	20	11	8	39	31	13.0	15.5
6/19	[20]	16	7	[43]	[36]	[14.3]	[18.0]
6/26	21	15	8	44	36	14.7	18.0
7/3	20	18	-	-	38	-	19.0
7/10	15	5			20		10.0
7/17	21	6			27		13.5
7/24	17	6			23		11.5
7/31	9	0			9		4.5
8/7	10	8			18		9.0
8/14	14	6			20		10.0
8/21	5	4			9		4.5
8/28	8	5			13		6.5
9/4	0	3			3		1.5
9/11	0	0			0		0.0

FIGURE 3. Average number of Calling doves per weekly trip.
Solid line -- Average of 2 routes.
Dotted line -- Average of 3 routes.
Broken line -- No trip on prescribed census day. (1951)



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In Table 12, monthly averages are given for each stop over the three 1951 call count routes. The data indicate that there is no direct correlation of number of doves calling at any particular station with any particular period of the nesting season.

Table 12.--Average Number of Doves Calling per Station (1951)

Station	April		May		June		July	Aug.
	Av. 2	Av. 3	Av. 2	Av. 3	Av. 2	Av. 3	Av. 2	Av. 2
1	0	0.3	1.5	1.0	0.5	0.3	0.5	0.5
2	2.0	2.0	4.0	6.0	0.5	3.0	3.0	0
3	0	0.3	2.5	3.3	3.0	2.3	3.5	0
4	2.5	2.3	3.0	2.7	1.0	1.3	2.0	0
5	2.5	4.0	5.0	6.7	2.0	2.7	1.5	0.5
6	2.0	2.0	1.5	2.0	2.5	1.7	2.5	1.0
7	6.0	5.0	5.0	4.0	4.5	4.7	7.0	2.0
8	3.5	3.0	4.5	3.0	3.5	3.0	5.5	4.5
9	3.5	3.0	2.0	1.7	4.0	3.3	4.0	3.5
10	3.0	3.0	5.0	4.3	5.0	4.3	5.5	1.0
11	7.5	5.0	2.5	2.0	8.0	5.7	6.5	8.0
12	4.5	4.0	2.0	1.3	3.0	2.0	4.5	1.0
13	1.5	1.7	0	0	1.5	1.3	2.0	1.0
14	3.0	2.7	1.5	1.3	2.0	1.7	2.0	0.5
15	4.0	3.3	6.5	4.3	5.0	3.3	2.0	2.0
16	3.5	2.3	3.5	2.3	3.5	2.3	1.5	1.5
17	1.0	0.7	1.0	0.7	3.5	3.0	3.0	0.5
18	2.0	1.3	0.5	0.3	0	0	0	1.0
19	2.5	1.7	3.5	2.3	1.0	0.7	2.0	1.0
20	0.5	0.3	0.5	0.3	0.5	0.3	0	0.5

Since the average number of times a dove called was 5.07 (Table 13) the total calls in Figure 4 were plotted on a scale which was five times the scale used to plot the total numbers of doves calling. The pattern shown in this graph seems to indicate that there is a direct correlation between the total number of doves heard and the total number of calls recorded. If this be true it would seem that a population index could be predicated on the total number of calls as well as on the total number of doves calling. However, it is believed that the latter would give a more reliable index. Admittedly, errors can arise in interpreting the total number of birds calling, especially if there are a large number at any one station. On the other hand, background noises are almost continually changing, and it is seldom possible to record accurately the number of times that all of the more distant birds call in the prescribed period. In our experience a great many of the distant individuals are recorded only 1 to 3 times during the three-minute stop, being frequently obscured by the noise of a slight breeze, distant traffic, or the songs of other birds.

Table 13.--Total Number of Times Doves Called

Date	Route 1	Route 2	Route 3	2 Routes Total	2 Routes Av.	3 Routes Total	3 Routes Av.
4/5	68	7	52	75	5.0	127	5.3
4/10	76	74	80	150	4.8	230	5.2
4/17	28	32	52	60	2.9	112	3.9
4/24	136	133	[22]	269	6.3	[291]	[6.2]
5/1	36	44	46	80	4.2	126	5.3
5/8	25	6	68	31	4.4	99	4.5
5/15	107	65	44	172	5.9	216	6.2
5/22	107	101	68	208	5.6	276	5.9
5/29	78	15	62	93	4.9	155	5.5
6/5	68	26	49	94	3.6	143	4.1
6/12	86	55	28	141	4.5	169	4.3
6/19		78	36	[78]	[4.9]	[114]	[5.0]
6/26	105	62	46	167	4.6	209	4.8
7/3	122	72		194	5.1		
7/10	60	16		76	3.8		
7/17	81	39		120	4.4		
7/24	84	38		122	5.3		
7/31	30	0		30	3.3		
8/7	44	43		87	4.8		
8/14	61	29		90	4.5		
8/21	16	31		47	5.2		
8/28	27	50		77	5.9		
9/4	0	12		12	4.0		
Totals	1,445	1,028	653				

Av. calls Route 1 - 4.68 per dove
Av. calls Route 2 - 5.11 " "
Av. calls Route 3 - 6.10 " "
Av. calls all Routes 5.07 " "

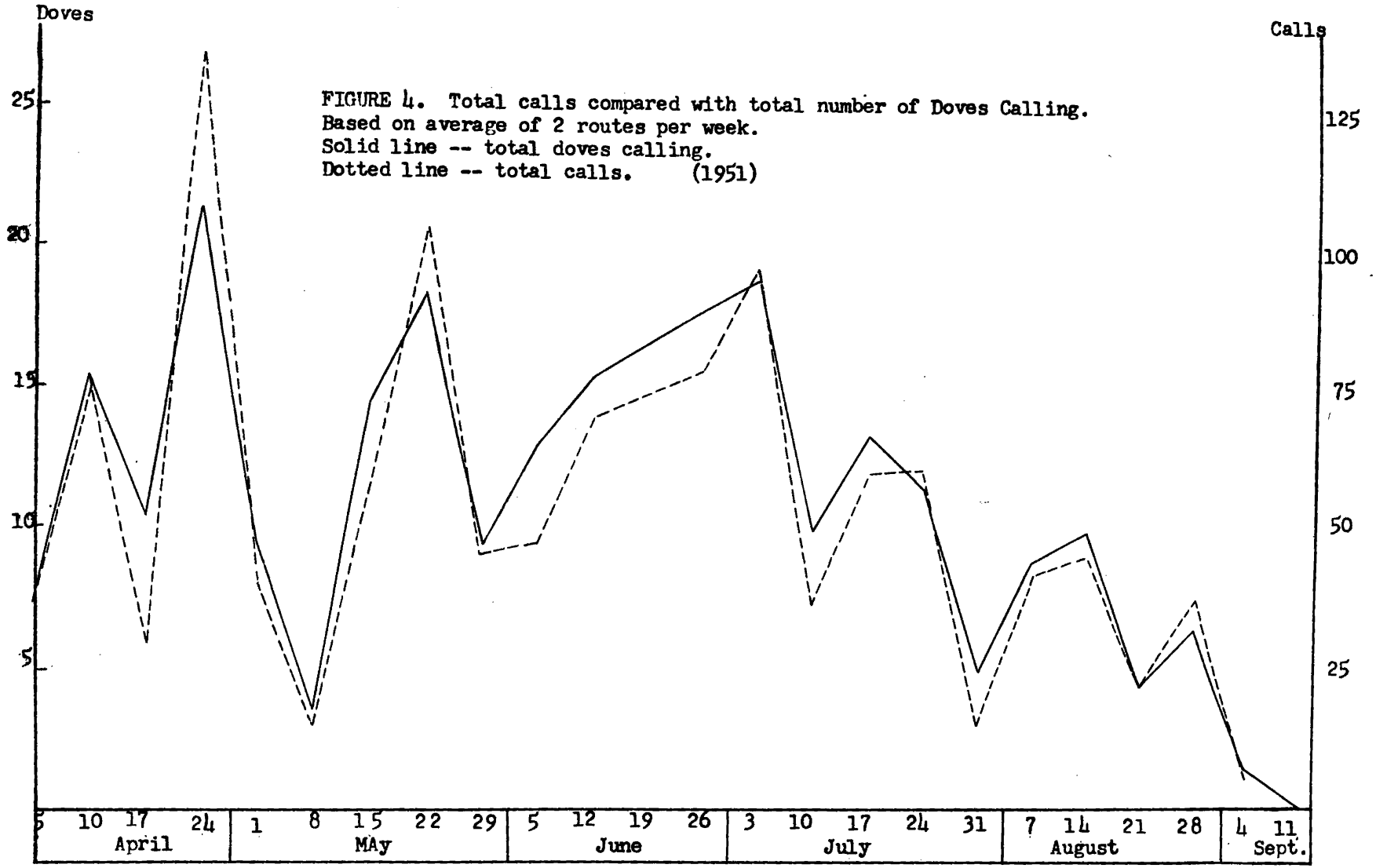

FIGURE 4. Total calls compared with total number of Doves Calling.
Based on average of 2 routes per week.
Solid line -- total doves calling.
Dotted line -- total calls. (1951)

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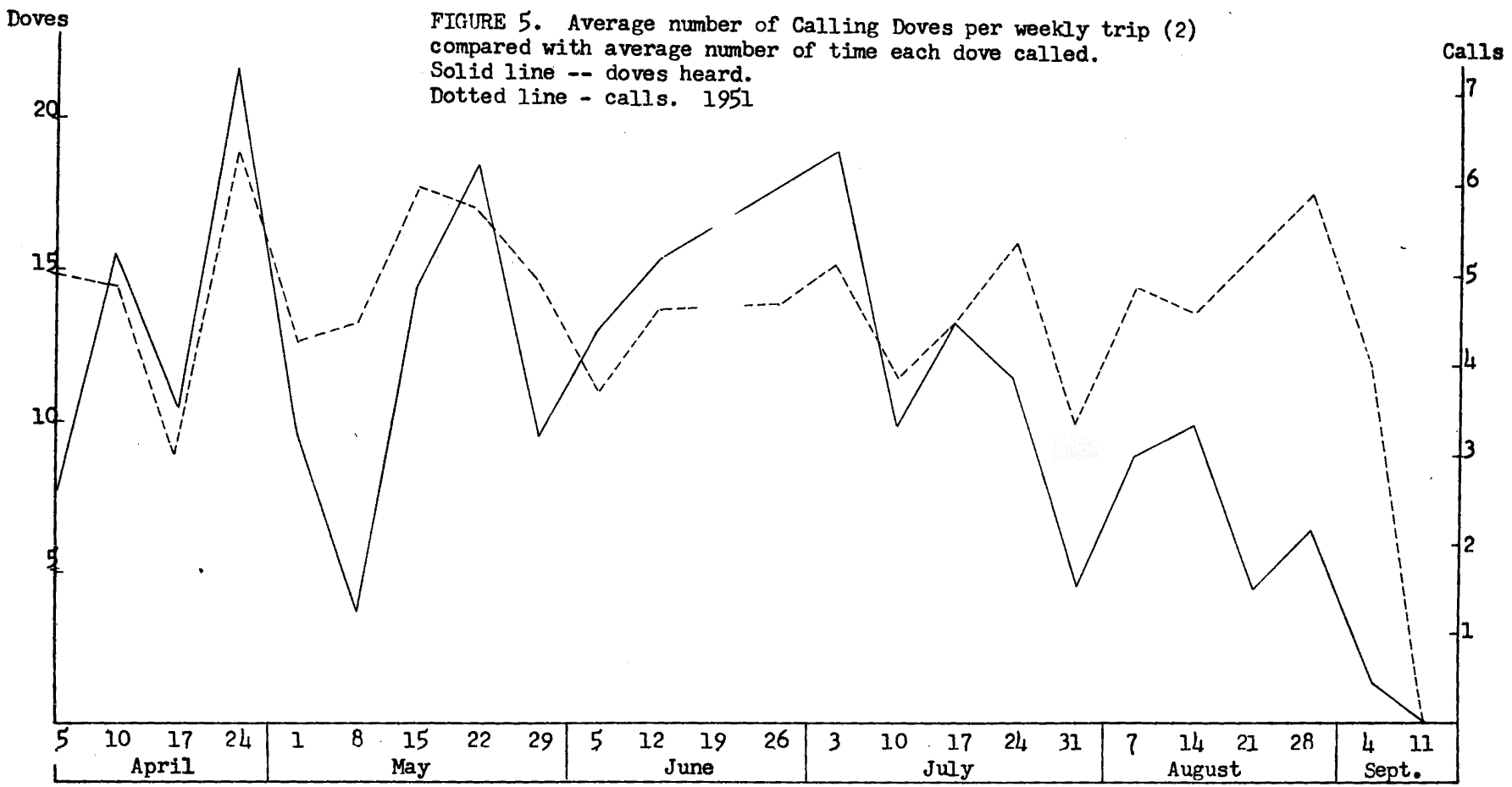
FIGURE 5. Average number of Calling Doves per weekly trip (2) compared with average number of time each dove called.
Solid line -- doves heard.
Dotted line - calls. 1951



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When the average number of calls per dove (Figure 5) is compared with the average number of calling doves, we find that individual doves called more frequently on those days in which relatively more doves were heard. Conversely, on days when relatively few doves were heard, there was a decrease in the average number of times individual birds called. Thus our data seem to indicate that there might be a correlation between the number of doves calling and the number of times each dove called during a particular period of the nesting season. This seeming correlation continues to prevail after the late June-early July peaks, even though the number of calling birds declines sharply.

Remarks.--From a statistical analysis of the 1951 data for routes #1, #2 and #3, during the period in which the census should be taken, Earl Atwood of the Fish and Wildlife Service found that 36 trips would be necessary to reflect a 15 percent change in any one of the routes. If all three routes were censused and considered as a unit only 12 trips per route would be needed.

Thus, the period from about May 15 to about June 26 allows for field studies to be completed in time to have the information available for consideration when annual hunting regulations are being formulated.

Summary

A call count over a 20 mile route (beginning 1/2 hour before local official sunrise and with 20 stops of 3 minutes duration 1 mile apart) gives a more practical index to the abundance of mourning doves in the breeding season than roadside counts and area population studies tried in 1950. Calling activities showed relatively high peaks and low depressions during April and May of 1951, with a plateau in June; a decline in calling was noted after July 3, and continued until September 11, when activity apparently ceased.

Although there seems to be a direct correlation between the total number of doves heard and the total number of calls recorded, available evidence indicates that the breeding index should still be based on the number of doves heard.

In general, more doves were heard calling than were seen up to about mid-July, 1951, after which time doves became conspicuous and relatively few were heard; and there was an increase in doves seen from July through September with a noticeable decline in October in central Maryland.

Very little difference was noted between morning and evening roadside counts from the end of July through October, although one route indicated that morning was more favorable. Our data probably are too meager to determine if any significant difference exists.

A statistical analysis of calling counts covering the period from May 15-June 26, 1951 indicates that with 3 routes, 12 trips per route must be made in order to reflect a 15 percent change.

Calling counts should begin in this area (central Maryland and northeastern Virginia) no later than May 15, and the counts must be completed by the end of the third week in June to conform to the present schedule of formulating hunting regulations.

A SUMMARY OF MOURNING DOVE CALL COUNT INVESTIGATIONS IN OHIO

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The Branch of Wildlife Research of the Fish and Wildlife Service has participated in the Cooperative Mourning Dove Study for nearly three years. From the beginning major emphasis has been directed at developing and testing various techniques for securing an index to dove populations on an annual basis. The object of investigations during the summer of 1950 and 1951 was to try to find the most economical and most reliable method of securing an index to the breeding population, one which could be applied annually to denote significant changes in abundance for regulatory purposes.

Preliminary investigations in Georgia, Pennsylvania and New York had shown promise of the call count method, so this was tested in detail in Ohio during 1950, and the study was intensified using standardized procedures in 1951. The research was conducted in Ohio because it was considered representative of an important segment of the northern part of the Mourning Dove's breeding range. Data from there would be particularly useful for comparison with similar investigations in other sections of the country.

The complete program in Ohio consisted of call counts, road counts, study area investigations, trapping and banding, and observations of movements and migrations. Only the results of the call-road counts will be discussed in this paper. These were conducted from early June until mid-August in 1950, and from May 2 until June 23 in 1951.

1950 Investigations

Methods.--Census routes were selected from a county road map, when possible, of 20 miles, through varied habitat, off main traveled roads and away from trains, airports, and similar sources of noise. Nine routes were established in Franklin County, Ohio, and four were chosen in Ottawa and Cuyahoga Counties, Ohio.

The routes were started approximately one-half hour before sunrise and consisted of three-minute stations about one mile apart. Routes were of 20 stations except one of 15 and another of 11. Records were kept of all doves heard to give the complete coo-call, but the number of calls from each dove were kept on only about half the routes. The doves seen while driving between stations were recorded, as well as those seen while at the stations. In each case the birds were tabulated as singles, pairs, or flocks; a flock being three or more doves.

The thirteen routes in central and northern Ohio were covered a total of 44 times; each route was counted from 2 to 7 times.

Results.--A summary of the results of the 44 counts during June, July, and August is given in Table 1 and Figure 1. The table shows the number of doves heard and seen, while the figure plots only those calling. When the calls are separated into those heard before sunrise, during the first hour after, and during the second hour after, a gradual build-up in calling activity is evident. Not only did more doves call in the first hour after sunrise but the frequency of the calls increased. This was evident during each of the three months as Tables 2 and 3 indicate.

The number of doves observed likewise increased with advancing daylight, especially in June, but a slight drop was noticed during the second hour after sunrise in July, and a more pronounced decrease occurred in August (Table 4). Usually more doves were seen while driving between stations than were observed while stopped, as shown in Table 5.

1951 Investigations

Methods.--After analyzing the results of the 1950 investigations in Ohio and comparing them with counts by investigators in other states, it was decided to standardize the call-road count route and method for further testing as follows: Counts were to start exactly one-half hour before local official sunrise; the route to be of 20 miles, with 20 stops of three minutes spaced one mile apart. The number of calls was to be recorded at each station as well as the number of doves calling, and the birds observed while driving and when stopped were to be separated into singles, pairs, and flocks. Consequently all of the 1951 counts in Ohio were conducted in accordance with this standard.

Results.--Forty-one call-road counts were made over 9 routes in central and northern Ohio during May and June. The work was conducted during these two months so that results could be summarized and submitted to the Service Committee responsible for the recommendation of appropriate hunting regulations in early July. Table 6 gives a summary of the doves heard and seen on the 41 counts, and Figure 2 plots the doves heard on 7 routes.

Two routes in Franklin County, Ohio, were selected for intensive study; route number 6 was covered 14 times, and route number 7 ten times. Results are plotted in Figure 3, while the doves heard at each station on all trips are shown in Table 7. This indicates some discrepancy between the birds heard at the same station on subsequent counts. Perhaps there is an occasional shifting between adjacent stations, but the differences in birds heard on different days may indicate the variation of calling activity during the nesting cycle. Little effect of climatic changes is apparent in the calling rate.

FIGURE 1.

Doves calling on central Ohio routes - 1950

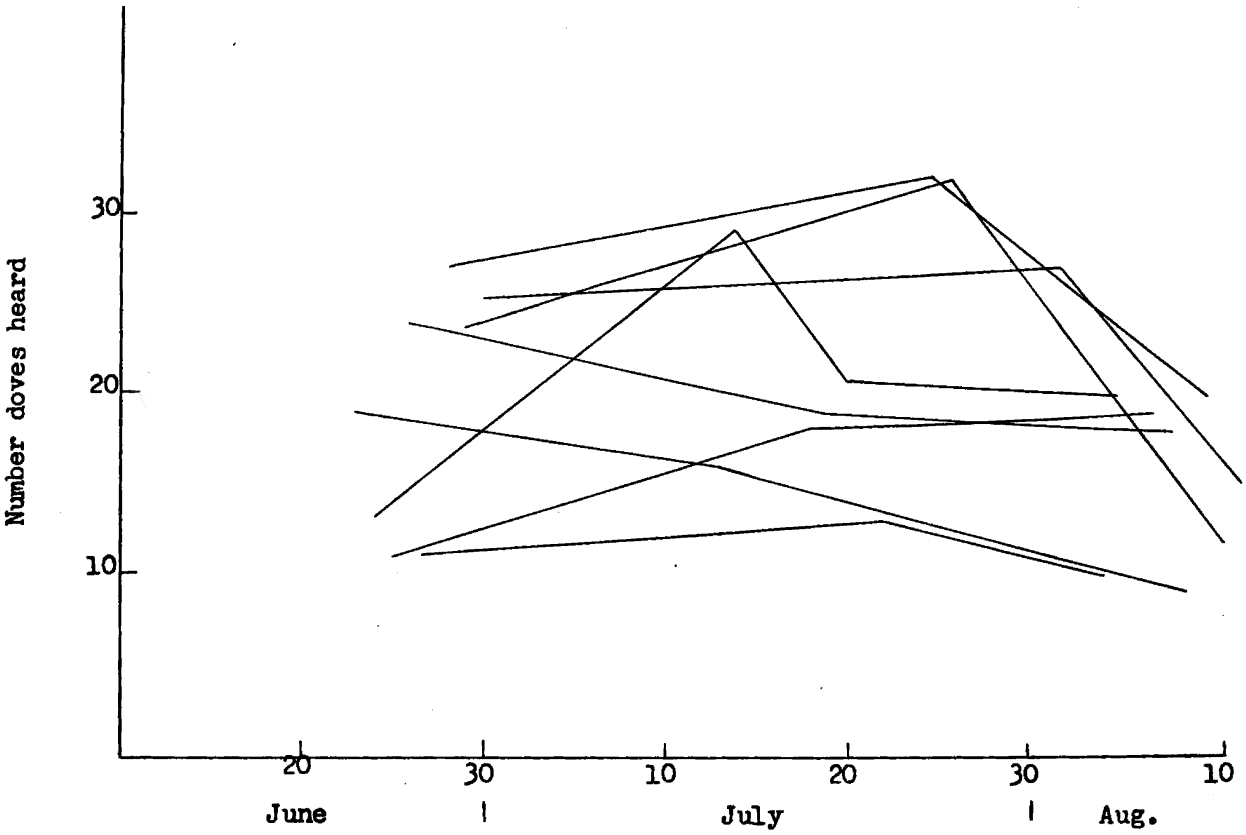

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Table 1.--Summary of all 1950-Call-road Counts *

Route No.	Date	No. Stops	Doves Heard: Total	Doves Heard: Before Sunrise	Doves Heard: After Sunrise	Doves Heard: Av. No. per Stop	Doves Heard: Av. Calls per Dove	Doves Seen: Total	Doves Seen: While Driving	Doves Seen: While Stopped	Sky	Wind Beaufort #	Temperature
1	6-10	11	12	3	9	1.09	4.7	12			Cloudy	2	67
1	6-11	11	14	4	10	1.27	4.2	23			Clear	0	53
1	6-18	11	14	10	4	1.27		22			Cloudy	1	48
1	6-21	11	22	12	10	2.0		37			Cloudy	0	63
1	7-6	11	24	14	10	2.18		34			Clear	0	62
1	7-16	11	15	11	4	1.36		16			Cloudy	1-2	67
1	8-6	11	17	10	7	1.55	5.4	13	13	0	Clear	0	49-51
2	6-9	20	17	9	8	.85	4.0	9			Clear	2	67-72
2	7-9	20	17	8	9	.85		17			Clear	0	53-57
2	8-6	20	14	3	11	.70		19			Clear	2	57-65
3	6-15	15	26	8	18	1.73		32			Clear	0	60-64
3	7-8	15	27	11	16	1.80		50			Clear	0	59-61
3	7-30	15	21	9	12	1.40		33	27	6	Clear	3-0	67
4	6-16	20	11	3	8	.55		21			Cloudy	0-3	67-68
4	7-10	20	36	13	23	1.80		67			Clear	0	61-68
4	8-1	20	11	5	6	.55		49	33	16	Clear	1	68-71
5	6-23	20	19	4	15	.95		85			Clear	0	64-66
5	7-13	20	16	3	13	.80		95			Cloudy	1	67-70
5	8-4	20	14	6	8	.70	5.7	24	22	2	Clear	0-1	47-56
6	6-24	20	13	3	10	.65		40			Cloudy	1	76
6	7-14	20	29	2	27	1.45	5.1	244			Clear	0	46-53
6	7-20	20	21	0	21	1.05	4.8	146	90	56	Cloudy	0	68-70
6	8-5	20	20	3	17	1.0	6.5	42	35	7	Clear	0-1	51-58
6	8-14	20	12	1	11	.60	4.8	41	32	9	Clear	0-1	47-55
7	6-25	20	11	1	10	.55		48			Cloudy	0	67
7	7-18	20	18	4	14	.90	5.3	83	56	27	Cloudy	0	69
7	8-7	20	19	5	14	.95	5.2	160	124	36	Clear	0	47-56
8	6-26	20	24	9	15	1.20		38			Cloudy	0	64-68
8	7-19	20	19	2	17	.95	6.9	35	25	10	Cloudy	1	64-66
8	8-8	20	18	3	15	.90	4.6	103	88	15	Clear	0	51-57
9	6-27	20	11	0	11	.55		18			Clear	1	57-60
9	7-22	20	13	2	11	.65	5.3	42	32	10	Clear	0	55-57
9	8-9	20	9	1	8	.45	3.6	25	18	7	Cloudy	0	60-64
10	6-28	20	27	7	20	1.35		35			Clear	0	46-50
10	7-25	20	32	7	25	1.60	6.2	99	29	70	Clear	0	54-59
10	8-10	20	20	4	16	1.0	5.3	34	32	2	Cloudy	0	65
11	6-29	20	24	9	15	1.20		23			Cloudy	0	60
11	7-26	20	32	8	24	1.60	5.9	11	10	1	Cloudy	0	62
11	8-11	20	12	5	7	.60	5.4	7	5	2	Cloudy	1-0	65
12	6-30	20	25	8	17	1.25		34			Clear	0-1	45-54
12	8-2	20	27	6	21	1.35	5.6	26	23	3	Clear	0-1	62-66
12	8-12	20	16	4	12	.80	3.7	37	30	7	Clear	0-1	50-56
13	7-1	20	16	7	9	.80		35			Clear	0	52-56
13	8-3	20	8	1	7	.40	3.4	70	35	35	Clear	1	53
44		802	823	248	575	1.03	5.24	2134	759	321			
				30.1%	69.8%				70.3%	29.7%			

* All of 20 stops, 19 miles, except Routes 1 and 3.

Table 2.--Summary of Call Counts in Franklin County, Ohio, 1950

1950 Month	Before Sunrise: No. of Stops	Doves Heard	Doves p/100 Stops	First Hour After: No. of Stops	Doves Heard	Doves p/100 Stops	Second Hour After: No. of Stops	Doves Heard	Doves p/100 Stops	Totals: No. of Stops	Doves Heard	Doves p/100 Stops	Percent Heard: Before Sunrise	First Hour After	Second Hour After
June	69	70	114.4	110	118	107.3	39	39	100.0	218	227	104.1	30.8%	51.9%	17.2%
July	63	59	90.5	100	132	132.0	42	44	104.8	205	235	114.6	25.1%	56.2%	18.7%
August	66	49	74.2	122	123	100.8	54	28	51.9	242	200	82.6	24.5%	61.5%	14.0%
Total	198	178	89.9	332	373	112.3	135	111	82.2	665	662	99.5	26.9%	56.3%	16.7%

Table 3.--Frequency of Calls
(For all Ohio call counts where individual calls were recorded)

1950 Month	Before Sunrise: No. Stops	Doves Heard	No. Calls	Av. Calls	First Hour After: No. Stops	Doves Heard	No. Calls	Av. Calls	Second Hour After: No. Stops	Doves Heard	No. Calls	Av. Calls	Total: No. Stops	Doves Heard	No. Calls	Av. Calls
June	13	14	52	3.71	26	28	139	4.96	16	11	38	3.45	55	53	229	4.32
July	39	25	138	5.52	70	103	608	5.90	30	36	189	5.25	139	164	935	5.70
August	66	49	274	5.57	119	116	593	5.11	46	27	112	4.15	231	192	979	5.09
Total	118	88	464	5.27	215	247	1340	5.43	92	74	339	4.58	425	409	2143	5.24

Table 4.--Summary of Doves Seen on Call-road Counts, Franklin County, Ohio (while driving and while stopped combined), 1950

Month (1950)	Before Sunrise: Number Seen	Doves p/100 Miles	1st Hour After: Number Seen	Doves p/100 Miles	2nd Hour After: Number Seen	Doves p/100 Miles	Total: Number Seen	Doves p/100 Miles	Percent Seen: Before Sunrise	First Hour After	Second Hour After
June	43	62.3	262	238.1	156	400.0	461	211.5	9.3%	56.8%	33.8%
July	185	293.7	471	471.0	197	469.0	853	416.1	21.7%	55.2%	23.1%
August	82	124.2	393	322.1	128	237.0	603	249.2	13.8%	66.3%	19.9%
Total	310	156.6	1126	339.2	481	356.2	1917	288.3	16.3%	59.0%	24.7%

Table 5.--Doves Seen on Call-road Counts, Comparison of Doves Seen While Driving with Those Seen While Stopped, Franklin County, Ohio

Month (1950)	Before Sunrise: Number Stops	While Driving	While Stopped	First Hour After: Number Stops	While Driving	While Stopped	Second Hour After: Number Stops	While Driving	While Stopped	Total: Number Stops	While Driving	While Stopped
July	34	16	29	61	175	66	25	51	79	120	242	174
August	66	70	12	122	320	73	54	88	40	242	478	125
Total	100	86	41	183	495	139	79	139	119	362	720	299
July %		35.6	64.4		72.6	27.3		39.2	60.8		58.2	41.8
August %		85.4	14.6		81.4	18.6		68.7	31.3		79.3	20.7
Average		67.7	32.3		78.1	21.9		53.9	46.1		70.7	29.3

Table 6.--Summary of All Call-road Counts, 1951, in Ohio *

Route Number	Date	Doves Heard			Doves Seen	Temp.	Percent Cloudy	Wind - Beaufort Number
		No.	Av. Calls	No. of Sta.				
6	5-2	18	5.3	12	4	61-64	75-30	1 - 0
9	5-3	14	5.6	10	7	62-64	75-25	1 - 2; 1 - 2
7	5-4	16	6.9	11	7	50-53	20-20	1; 0 - 1
10	5-5	28	5.3	17	8	45-43	65-50	1 - 2
6	5-7	18	6.2	10	12	40-44	0-0	1 - 0
6	5-8	18	6.6	10	7	46-50	0-0	1 - 2
6	5-9	24	8.3	13	9	47-54	0-0	0 - 1
12	5-10	7	6.3	4	3	53-51	100-100	1 - 2; 2
7	5-11	21	4.7	14	7	58-60	100-100	2 - 4; 1
4	5-12	4	8.5	4	12	44-46	50-0	1; 2
7	5-14	15	6.9	9	12	43-47	0-0	1; 0 - 1
7	5-15	21	5.9	10	5	45-53	0-0	0 - 0
7	5-16	20	7.0	12	3	49-54	0-0	0 - 0
5	5-17	10	5.9	7	5	56-61	25-10	0; 0 - 1
6	5-18	13	4.6	10	9	50-54	0-0	1 - 2
8	5-19	14	4.6	8	21	59-61	0-0	0 - 1; 1
2	5-20	10	2.1	7	3	54-58	0-0	1 - 3; 2 -3
6	5-21	28	6.7	13	13	57-61	50-25	0 - 1; 0
6	5-22	28	5.5	13	10	57-64	10-30	0 - 0
6	5-23	4	2.5	4	12	51-51	100-100	2 - 5; 2 - 5
11	5-24	23	5.0	13	12	42-46	0-0	0 - 0
7	5-25	17	6.6	11	9	51-54	0-0	0; 0 - 1
9	5-26	13	4.2	10	5	56-59	50-75	1 - 1
7	5-28	15	5.7	13	8	50-53	100-100	0 - 1; 1 - 2
7	5-29	13	6.9	8	10	51-53	100-100	0 - 1; 1 - 2
7	5-30	23	8.2	11	11	50-55	0-0	0 - 0
10	5-31	29	6.1	17	26	50-54	0-0	0 - 0
6	6-1	26	6.2	14	9	63-65	100-10	0 - 1; 0 - 1
6	6-4	18	4.9	12	9	63-64	100-100	0 - 1; 0 - 2
6	6-5	15	7.6	9	3	53-53	100-100	1 - 2; 2 - 3
6	6-6	17	8.6	10	8	43-48	5-5	0 - 0
2	6-14	14	4.1	8	7	56-58	100-100	0 - 2; 0 - 1
6	6-15	27	6.3	14	15	54-57	67-10	0; 0 - 1
12	6-16	25	5.6	12	16	50-57	0-0	0 - 0
7	6-17	30	6.4	17	21	57-60	10-10	0 - 1; 0 - 1
5	6-18	16	6.0	10	20	57-60	0-0	0 - 1
8	6-19	20	6.2	12	25	60-64	15-0	0; 0 - 1
11	6-20	15	4.6	8	16	67-68	20-100	1; 1 - 2
9	6-21	15	5.1	9	15	57-60	0-0	0 - 0
10	6-22	21	5.1	11	10	67-64	67-10	1; 1 - 2
6	6-23	23	5.9	13	19	64-67	15-15	0 - 0

* All of above routes were of 20 stations, 20 miles.

FIGURE 2.

Doves calling on Ohio Routes - 1951

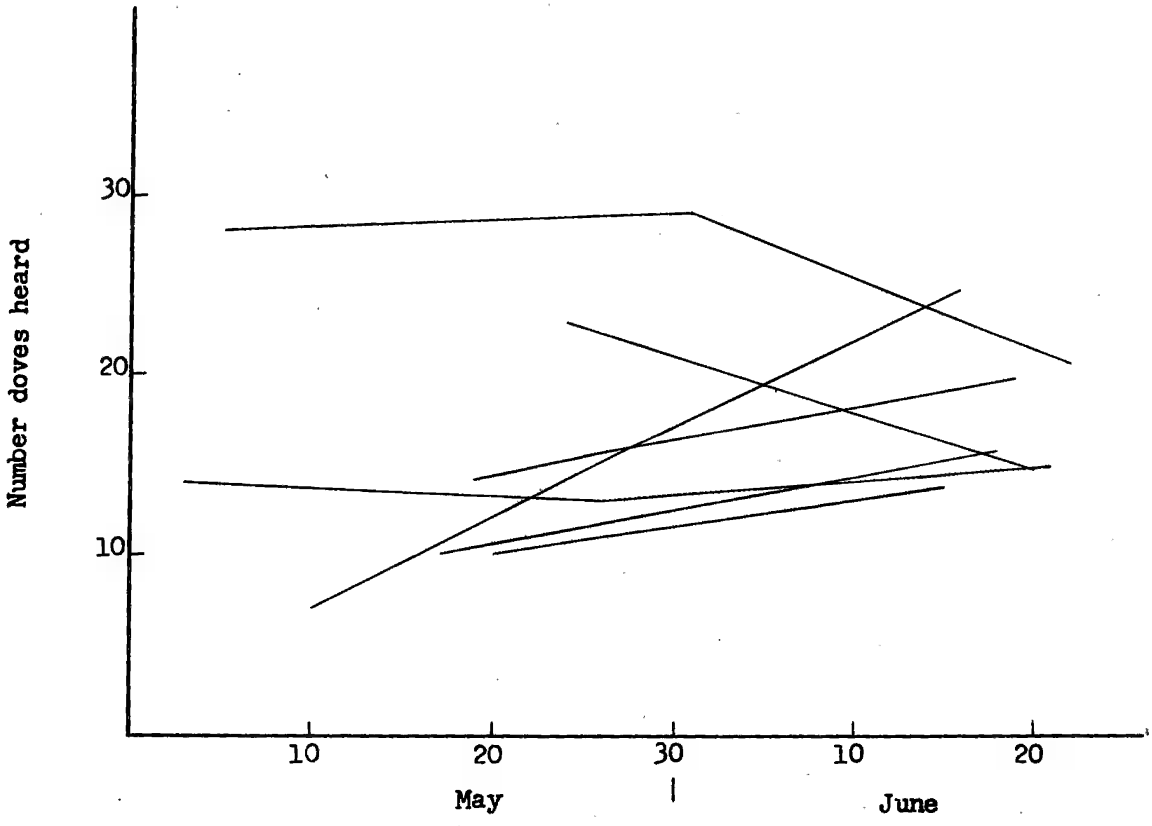

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FIGURE 3

Doves calling on Routes 6 and 7,

Franklin Co., Ohio

1951

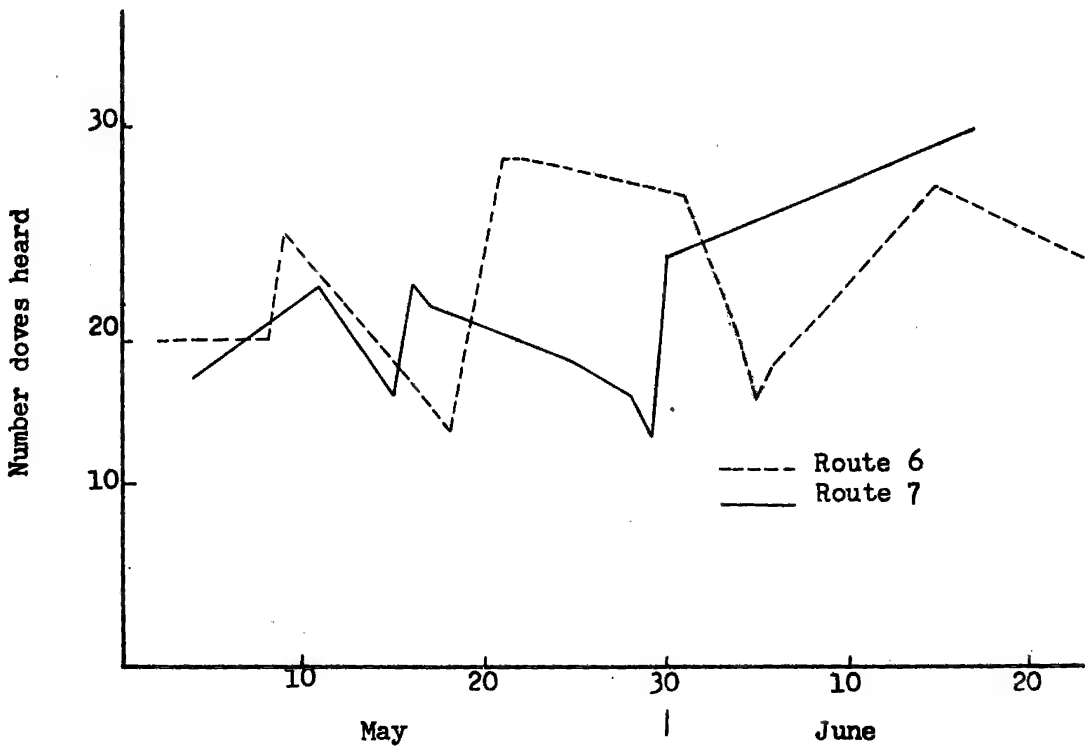

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Table 7.--Summary of Intensive Mourning Dove Call-road Counts, May and June, 1951, Ohio

	Route #6, West of Columbus														Route #7, Southeast of Columbus									
Sta. #	5-2	5-7	5-8	5-9	5-18	5-21	5-22	5-23	6-1	6-4	6-5	6-6	6-15	6-23	5-4	5-11	5-14	5-15	5-16	5-25	5-28	5-29	5-30	6-17
1															2		2		2	2	1	3	4	4
2															1	1	1	2	2	2	1	1	1	4
3						1									3	1	3	2	2	2	1	2		2
4	1			1	1	4	3		1				1	1		2		2	3	1				2
5	3		3	4	2	4	4		3	1	4	4	5	4	1	3	1	3	1	2	1		3	1
6	2	1	1	3	1	3	3	1	2			2	2	2	1	1		1		1				1
7		1	2	2	1	3	2		2	1	2	2	3	1		2			1		1			1
8	1		3	2	2	2	3	1	2	3	2	1	1	3			2	2	2			2	2	2
9	2	1		1		3	1		3		1	2	1	1	1	3	3	3	2	2	1		3	1
10	2	2		3		2			3	1		1	1		1	1	1	1	1	2	1	2	1	
11	1	3	2	3					1	1		1	2		2	1	1	4	2	1	1	1	3	2
12	1	2	1	1		2	1		1	2	1	1	2	1	2		1		1	1		1	3	3
13	2		2	1	1	1	3		2	2	2	2	4	3		1				1	1	1	1	
14		2	1	1			2		1	1			1	1		1			1		2			
15	1	2				1	2	1		1	1		1	1							1		1	1
16	1	1			1		2		2							1								1
17	1		1	1	1	1	1		2	2	1	1		1										1
18		3	2	1	2	1			1	1			2	2							1			1
19							1			2	1				1	2		1					1	2
20					1			1					1	2	1	1					2			1
Total	18	18	18	24	13	28	28	4	26	18	15	17	27	23	16	21	15	21	20	17	15	13	23	30
#Sta.	12	10	10	13	10	13	13	4	14	12	9	10	14	13	11	14	9	10	12	11	13	8	11	17
Av. Calls	5.3	6.2	6.6	8.3	4.6	6.7	5.5	2.5	6.2	4.9	7.6	8.6	6.3	5.9	6.9	4.7	6.9	5.9	7.0	6.6	5.7	6.9	8.2	6.4
#Seen	4	12	7	9	9	13	10	12	9	9	3	8	15	19	7	7	12	5	3	9	8	10	11	21
Temp.	61	40	46	47	50	57	57	51	63	63	53	43	54	64	50	58	43	45	49	51	50	51	50	57
	64	44	50	54	54	61	64	51	65	64	53	48	57	67	53	60	47	53	54	54	53	53	55	60
% Cloud.	75	0	0	0	0	50	10	100	100	100	100	5	33	15	20	100	0	0	0	0	100	100	0	10
	30	0	0	0	0	25	30	100	10	100	100	5	10	85	20	100	0	0	0	0	100	100	0	90
Wind	1	1	1-2	0-1	1-2	0-1	0	2-5	0-1	0-1	1-2	0	0	0	1	2-4	1	0	0	0	0-1	0-1	0	0-1
	0	1-2	1-2	0-1	1-2	0	0	2-5	0-1	1-2	2-3	0	0-1	0	0-1	1	0-1	0	0	0-1	1-2	1-2	0	0-1

Averages: Route #6: Counted 13 times. (May 23 count not included in averages). 22.0 heard. 9.8 seen. 6.3 calls per dove.

Route #7: Counted 10 times 19.1 heard. 9.3 seen. 6.5 calls per dove.

During May and June of 1951 the activity of calling doves closely paralleled that of June, July, and August of 1950. Table 8 shows the same gradual increase in activity with advancing daylight, but a drop during the second hour after sunrise. Doves were found to call less frequently with advancing daylight in 1951, as Table 9 indicates. The average calls per dove was greater in 1951 than in 1950; possibly the larger sample in 1951 gives a truer picture, for there is a definite correlation between dove populations and the rate of calling.

More doves were observed while driving than while at stations in both 1950 and 1951. Table 10 summarizes the data demonstrating this for 1951 and also shows that most of the doves were seen during the first hour after sunrise.

Comparison of 1950 with 1951

Table 11 compares the average number of doves heard on repeated counts of 8 Ohio routes in 1950 with those heard on the same routes in 1951. In 1950 there were 29 counts of these 8 routes which averaged 18.2 doves per count, while in 1951 the 8 routes were counted 39 times and averaged 18.9 doves per count. Because counts were made in different months in the two years, single counts over each route in June of both years are also compared. The totals of these June counts show a slightly greater population in 1951 although some individual counts give opposite results. This indicates the need for conducting a sufficiently large number of counts in each area, or each state to obtain statistically valid data upon which to base population fluctuations.

While more doves were heard during 1951 than during 1950 there were fewer doves seen during 1951 on the same Ohio routes. Table 12 gives a comparison of the averages of repeated counts of each route for the two years. When the June counts are compared the difference is not so pronounced, but they do show a decrease in the numbers of doves seen.

Tables 11 and 12 show, also, that sight records vary more than counts of calling doves. The call count index seems to be subject to less variation and is therefore more reliable as a census technique. Further study of the data show that the production of young doves was evidently lower in June 1951 than in 1950, since the numbers of calling (breeding?) doves decreased slightly. Other studies in Ohio during the two summers indicated a later nesting season in 1951, but that the total production of young doves by the end of the summer was about the same as in 1950. This illustrates the danger of forecasting the total production by counts made in May and June, when about half the breeding season still remains.

Table 8.--Summary of Call Counts, Franklin County, Ohio, 1951

1951 Month	Before Sunrise			First Hour After			Second Hour After			Totals			Percent Heard		
	No. of Stops	Doves Heard	Doves p/100 Stops	No. of Stops	Doves Heard	Doves p/100 Stops	No. of Stops	Doves Heard	Doves p/100 Stops	No. of Stops	Doves Heard	Doves p/100 Stops	Before Sunrise	First Hour After	Second Hour After
May	125	122	97.6	250	259	103.6	125	69	55.2	500	450	90.0	27.1%	57.6%	15.3%
June	65	55	84.6	130	158	121.5	65	55	84.6	260	268	103.1	20.5%	59.0%	20.5%
Total	190	177	93.2	380	417	109.7	190	124	65.3	760	718	94.5	24.7%	58.1%	17.3%

Table 9.--Frequency of Calls, Franklin County, Ohio, 1951

1951 Month	Before Sunrise				First Hour After				Second Hour After				Total			
	No. Stops	Doves Heard	No. Calls	Av. Calls	No. Stops	Doves Heard	No. Calls	Av. Calls	No. Stops	Doves Heard	No. Calls	Av. Calls	No. Stops	Doves Heard	No. Calls	Av. Calls
May	125	122	805	6.60	250	259	1583	6.11	125	69	368	5.33	500	450	2756	6.12
June	65	55	342	6.22	130	158	946	5.99	65	55	332	6.04	260	268	1620	6.04
Total	190	177	1147	6.48	380	417	2529	6.06	190	124	700	5.65	760	718	4376	6.09

Table 10.--Summary of Doves Seen While Driving and While Stopped on Call-road Counts, Franklin County, Ohio, 1951

1951 Month	Before Sunrise: Total No. Stops	Before Sunrise: No. Doves Seen While Driving	Before Sunrise: No. Doves Seen While Stopped	Before Sunrise: Doves Seen Per 100 Miles	First Hour After: Total No. Stops	First Hour After: No. Doves Seen While Driving	First Hour After: No. Doves Seen While Stopped	First Hour After: Doves Seen Per 100 Miles	Second Hour After: Total No. Stops	Second Hour After: No. Doves Seen While Driving	Second Hour After: No. Doves Seen While Stopped	Second Hour After: Doves Seen Per 100 Miles	(Balance of Table cont'd below) *
May	125	12	2	9.6	270	137	21	50.7	125	49	13	39.2	
June	65	15	3	23.1	130	99	25	76.2	65	39	2	60.0	
Total	190	27	5	14.2	400	236	46	59.0	190	88	15	46.3	

*

Percent of Doves Seen Before Sunrise	Percent of Doves Seen First Hour After	Percent of Doves Seen Second Hour After	Percent of Doves Seen While Driving	Percent of Doves Seen While Stopped
6.1%	69.2%	24.7%	84.6%	15.4%
9.8	64.7	25.5	83.6	16.7
7.7%	67.2%	25.1%	84.2%	15.8%

Table 11.--Comparison of Calling Doves on 8 Routes in Central Ohio

Route No.	Average of Counts 1951	1950	Single Counts Over Route at Approx. Same Date in June 1951	1950
5	13	16.3	16	19
6	21	19	23	13
7	19.1	16	30	11
8	17	20.3	20	24
9	14	11	15	11
10	26	26.3	21	27
11	19	22.6	15	24
12	25	22.6	25	25
Totals of Averages	154.1	154.1	Totals 165	154

1951: Total of 39 call counts was 738, averaging 18.9 doves per count.
1950: Total of 29 call counts was 549, averaging 18.2 doves per count.

Table 12.--Comparison of Doves Seen During Call-road Counts in 8 Routes in Central Ohio

Route No.	Average of Counts 1951	1950	Single Counts Over Route at Approx. Same Date in June 1951	1950
5	12.5	68.0	20	85
6	9.7	102.6	19	40
7	9.3	97	21	48
8	23	58.7	25	38
9	9	28.3	15	18
10	14.7	56	10	35
11	14	13.7	16	23
12	8.5	32.3	16	34
Totals of Averages	100.7	456.6	Totals 142	321

Comparison of Calling Doves in Pennsylvania and New York

During June 1950, A. J. Duvall and C. S. Robbins, Fish and Wildlife Service, made counts on two routes in Erie County, Pennsylvania, and four routes in northwestern New York. The writer repeated these routes during June of 1951. Table 13 compares the numbers of calling doves over the routes during the two years, and indicates a reduction in numbers. However due to a different observer with different acuity of hearing in 1951, counts that year may not have included occasional very distant doves which would have been heard by the 1950 observers. Consequently it is believed the decrease may not have been as much as indicated by the figures.

Table 13.--Doves Heard on Routes in Northwestern Pennsylvania and Western New York

Route No.	Location	1951	1950
8&9	Erie County, Pa.	20	23
10	Niagara County, N. Y.	20	43
11	Niagara County, N. Y.	20	40
12	Genesee and Orleans County, N. Y.	20	11
13	Wayne County, N. Y.	41	48
	Totals	121	165

Conclusions

Two summers of Mourning Dove call-road counts in Ohio provided opportunity to test and develop this method of indexing the breeding population. Because the 1950 work was conducted in June, July, and August and that of 1951 was in May and June, all of the results cannot be compared directly; yet the same general conclusions are indicated from the work of each year. Judging from tests of my data by Leonard Foote, counts made in June of both years may furnish a statistically reliable method of denoting changes in dove populations.

The standardized route of 20 stations in 20 miles will be further tested in 1952 with counts on the same Ohio routes for direct comparison with the 1951 results.

PRELIMINARY INVESTIGATIONS ON MOURNING DOVE INDEX AND SURVEY METHODS IN WISCONSIN

By Frederic H. Wagner
University of Wisconsin and
State of Wisconsin Conservation Department

Introduction

Three mourning dove inventory and survey methods were begun in Wisconsin in the spring, summer, and fall of 1951 to provide yardsticks of breeding population levels, yearly production, and geographical abundance. Data on locations and phenology of premigratory build-up and departure were also desired. As with other states in which the dove is not on the gamebird list, such indices had to be of a sort which could be operated at little or no expenditure of funds and manpower. This preliminary work was done under joint sponsorship of the University of Wisconsin Department of Wildlife Management and the Wildlife Management Institute and in cooperation with the Wisconsin Conservation Department.

Calling Count Transects

Three call count transects in south-central Wisconsin were run as prescribed by biologists of the Cooperative Dove Study. They were run weekly on routes already in use by the Wisconsin Conservation Department as quail, pheasant, and grouse transects with a view toward gathering data on more than one species at the same time, thereby pooling transportation and manpower. From the start, it was obvious that one man could attend adequately to only one species. This system, then, although requiring an extra man for doves, involved no extra transportation costs during the pheasant- and quail-calling and grouse drumming seasons.

The transects were run from early April to early August. The purpose of the work done on these transects was to determine the seasonal calling curve, ascertain the best period on that curve in which to run more extensive counts, and to attempt to appraise the sensitivity of this index method. The results, as shown in Figure 1, indicate a build-up to a peak in late April and early May corresponding to a period of migratory arrival and prenesting pair formation. This peak drops off with the onset of nesting to a rough plateau in latter May and in June. All transects are in rough agreement on these points. Routes 1 and 2 build up to a second peak in early July while Route 3 shows only a trace of a tendency in that direction. The roughly

similar trends in all routes, the extremely close parallel between Routes 2 and 3 (possibly indicating that populations of similar magnitude were being sampled), and the fact that early peaks in Routes 1 and 2 were almost identical in height with late ones, all lead to the conclusion that these counts are quite sensitive.

Since the calling level is fairly stable for several weeks during the midseason plateau, this period seems to be the best time during which counts should be made. Table 1 presents statistical summaries of the three 1951 Wisconsin routes, comparing measurements on counts run throughout May and June, and counts run only between May 15 and June 26. In comparing the Coefficients of Variation for the two analyses, it is obvious that by running counts between the early May and July peaks less variation is encountered. Less variation should enable detection of smaller population changes.

Table 1.--Statistical Summary of Wisconsin Call Counts Taken During May and June of 1951

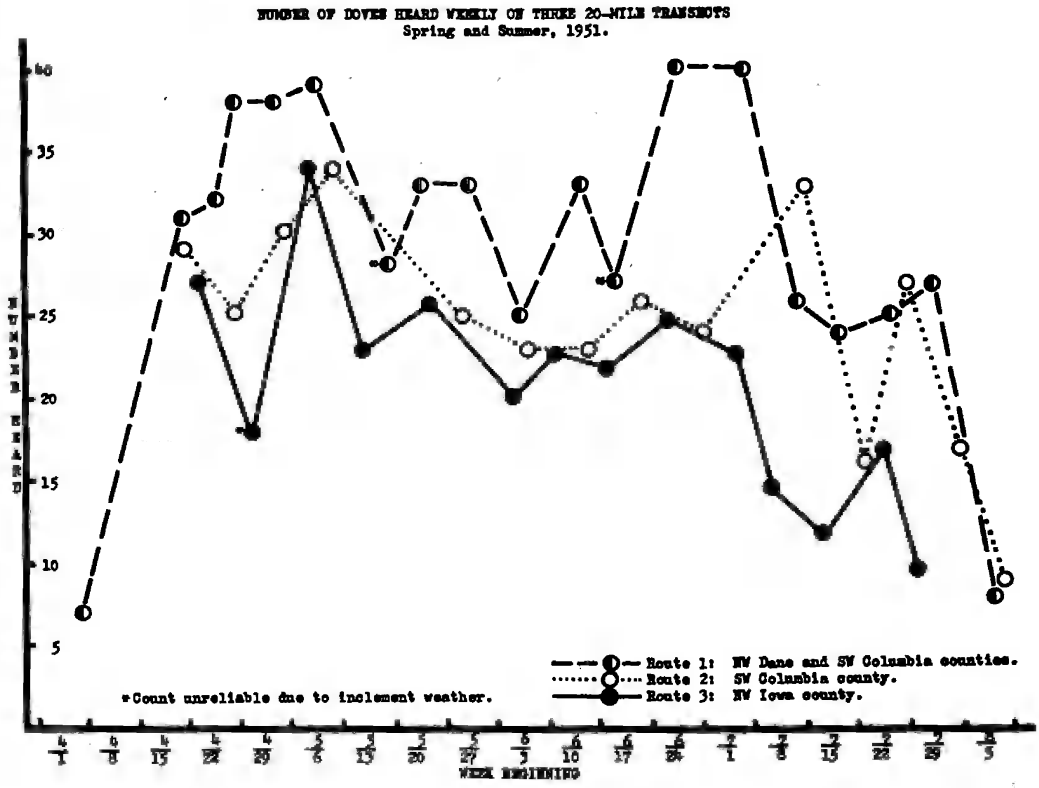
	No. of Counts		Mean		Std. Dev.		Coef. of Var.	
	5/1-6/30	5/15-6/26	5/1-6/30	5/15-6/26	5/1-6/30	5/15-6/26	5/1-6/30	5/15-6/26
Route 1	9	6	32.9	29.8	5.10	3.61	15.5%	12.1%
" 2	6	4	26.8	24.3	4.53	2.26	17.3%	6.2%
" 3	8	6	23.8	23.1	4.68	2.10	19.9%	4.6%

It must be remembered that these are tentative conclusions based only on one year's work. These seasonal calling curves therefore need further scrutiny before it can be said with certainty at what periods call counts should be run. As yet we know nothing of year-to-year phenological changes or effects of different population levels on calling pattern.

Rural Mail-Carrier Surveys

In an attempt to get quantitative data on geographical abundance of breeding doves in Wisconsin, a rural mail-carrier survey was employed. The peak of nesting during the first brood was selected as the time during which to run this survey. At this time there are virtually no young of the year in the population and the carriers truly would be counting breeding adults. It was also hoped that at this period there would be virtually no

FIGURE 1


NUMBER OF DOVES HEARD WEEKLY ON THREE 20-MILE TRANSECTS
Spring and Summer, 1951.
40
35
30
25
20
15
10
5
Route 1: NW Dane and SW Columbia counties.
Route 2: SW Columbia county.
Route 3: NW Iowa county.
*Count unreliable due to inclement weather.
WEEK BEGINNING

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shifting about of the populations. In 1950, nesting studies in south-central and northwestern Wisconsin indicated a phenological difference of about three weeks. In view of this south-north phenological gradient, the state was arbitrarily cut into four east-west bands, and the mail carrier counts were run on four consecutive weeks in the four bands. Thus, the southernmost band was run in the first week, and each band northward was run progressively a week later. In this manner it was hoped that the counts were being made during the same period in the nesting season throughout the state.

Carriers were asked to make counts on three days during the week, preferably during good weather. They were asked to record weather conditions, time of day route was run, length of route, exact location of route (township(s) and distances and directions from nearest towns), and willingness to make more counts in the future. Advantages of this method are the slight expense and small time involved in getting a large volume of data.

The results of this survey were extremely gratifying. Out of an estimated 1,000 carriers in the state, 871 returned forms, 767 of which were usable. The great majority were very cooperative and indicated willingness to make more counts in the future.

It was not possible to plot all 767 counts on a map. Therefore only the 119 high counts (arbitrarily, those of 10 or more doves per hundred miles) were plotted. Figure 2 is the resultant map.

From this map the tendency for high populations to occur along rivers is quite striking. Since there is surely no shortage of water in Wisconsin for doves, I suspect that the birds are drawn to streams, not by the water itself, but by the sandy outwash plains of the rivers. In Wisconsin doves appear to prefer sandy regions, and several of the larger rivers in the state such as the Mississippi, Wisconsin, Chippewa, and others have sandy outwash plains, in places several miles wide.

A second generalization to be drawn from the map is the tendency for high populations to occur south and west of a line drawn between the northwest and southeast corners of the state. This line roughly coincides with the tension line between the original prairies and deciduous forest (Curtis, 1951). Doves in Wisconsin, then, tend to occur in the prairie half of the state. This coincides with other reports which suggest that high dove populations occur in the prairie states (McClure, 1943; recent call count findings; others).

These two generalizations can be made from a subjective scrutiny of the map. Initially this survey was made with these objectives in mind--to find out what could be learned of dove range in the state. However, with the quantity of data obtained they may be useful as yearly indices of breeding populations to complement call counts. In order to compare variability of these counts with the wintering-ground mail-carrier indices run in the South, the data were analyzed as directed by Moore (1951). The results were compared with the southern analyses of Foote (1951), and it was found that it would be possible to detect nearly the same amount of population change (13% as compared with about 10%) with less than one-third the amount of data used in the South. The Coefficient of Variation was also about one-third less than that for the much more voluminous southern data. In all probability, the analysis can be further refined through some sort of ecological stratification of the data. The data so far have only been analyzed for the state as a whole. Statistical comparisons between the southern and Wisconsin data can be seen in Table 2.

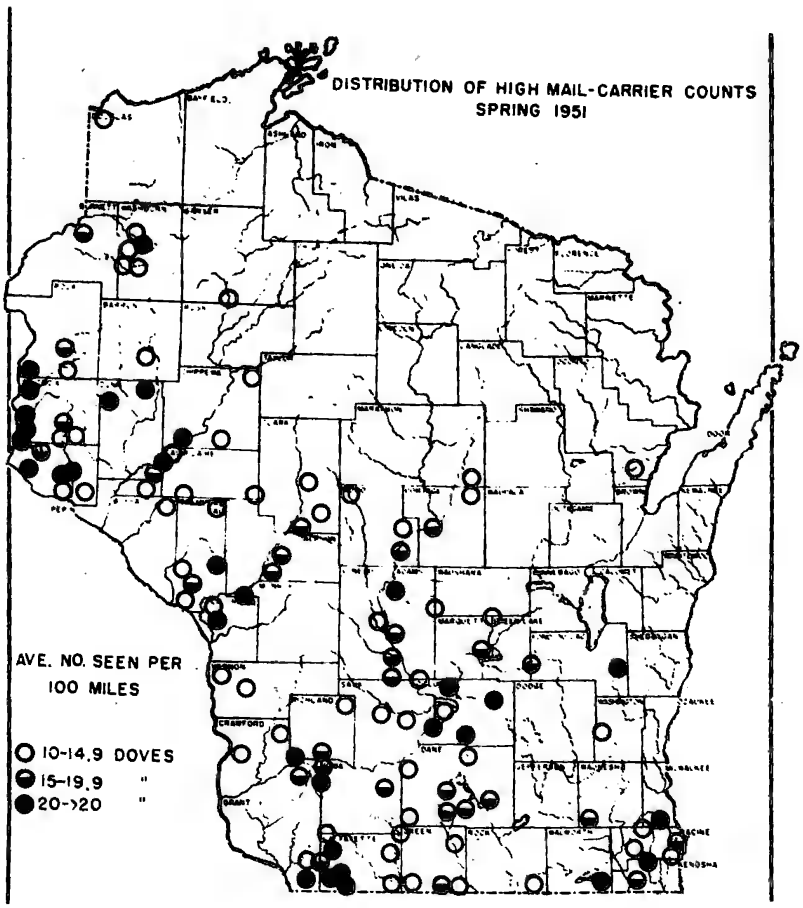
Table 2.--Statistical Summary of Wisconsin and Southern Mail Carrier Surveys

	No. Routes	Av. No. Doves/100 Miles	σ Doves/100 Miles	σ_m Doves/100 Miles	Coef. Var.	% Change of x for Significance*
6 Southern States, Winter of 1950	2923	16.95	29.3	0.542	173%	9.6%
Wisconsin, Spring of 1951	767	6.0	6.6	0.24	110%	13%

* Based on $3\sigma_m$ units giving significance at the 99.7% level.

This greater sensitivity due to less variation doubtless is due to more random distribution of birds during the breeding season than on the wintering grounds (Nelson, et al., 1951). These counts may also be less vulnerable to the vagaries of weather than wintering populations, since Foote (1951) has pointed out that gross weather changes may greatly affect the disposition of wintering dove populations, entering serious sources of error into the winter inventories.

FIGURE 2


DISTRIBUTION OF HIGH MAIL-CARRIER COUNTS
SPRING 1951
AVE. NO. SEEN PER
100 MILES
10-14.9 DOVES
15-19.9 "
20->20 "

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These counts may have one further use. If run once at the beginning of the breeding season and then again about one or two months later, they may be useful in showing early season production. This and the above possibilities should be explored in subsequent years.

In summary, I believe that the mail-carrier surveys of breeding season dove populations have sufficient potentialities to warrant their further study. With the types of geographical relationships disclosed by the Wisconsin counts, I believe that it is extremely desirable that these counts be conducted throughout the range of the Mourning Dove. First, they might give us a great deal of information on the basic ecology of the species. Secondly, in a hunted, migratory species, we should know the regions of high populations, and hence, regions of high contributions to the bag. These surveys might provide this knowledge. And finally, they could be the source of inexpensive population indices. In the field of wildlife management, the opportunities to get large amounts of data easily and cheaply are few and far between. The mail-carriers of the country represent a huge potential source of information, and the Mourning Dove, by its open and conspicuous habits, may be one of the few if not the only game bird which really lends itself well to this method.

Flocking Counts

A third survey method was set up to obtain data on fall flocking tendencies. All game research and management personnel of the Wisconsin Conservation Department were requested to keep data on the size, location, time of day, and activity of all flocks of four or more birds seen during the regular performance of their duties. Observations were begun in late July and continued until the birds had departed.

The purposes of these observations were three-fold; (1) to compare geographical range of flocks with the breeding range obtained through the mail-carriers; (2) to obtain dates on premigratory build-up and departure; and (3) to explore the possibilities of using this method as a population index. The advantages of this method are that there are no extra expense or time involved.

Three-hundred-ten flock observations were reported. The average flock sizes and number of flocks seen of 307 of the observations are represented graphically in Figure 3. Number of flocks seen is graphed only for the period of intensive observations between August 5 and September 22. These represent the dates, respectively, of the request for the counts, and the request for return of accumulated observations.

It appears from the graph that the number of flocks and the average flock size reached a peak in August, then began declining in September. Although the observations are fewer, there appears to have been a tendency for the flock size again to have increased in late September.

In Figure 4, all flocks reported, including observations from interested observers not in the Conservation Department, are mapped. The distribution displays a southwesterly orientation, roughly similar to the breeding range as pictured through the mail-carrier counts.

Summary

1. Based on three 1951 call count transects, southern Wisconsin doves seem to have a fairly level plateau of calling from about May 15 to June 26. This plateau is bounded by peaks in early May and early July.

2. Since little variation occurs during this plateau period, it is tentatively recommended that call counts in this region be made during this period.

3. Usable returns from 767 rural mail-carriers indicate fair numbers of doves west and south of a line drawn between the northwest and southeast corners of the state. Doves are much less numerous north and east of this line.

4. On the possibility that these data may be usable for breeding population indices, the variation was analyzed statistically by a method prescribed by Moore (1951). This method of analysis indicates that a 13% population change can be detected in the over-all state population. There is a good possibility that some sort of ecological stratification of the data can increase the precision of this method.

5. Using two mail-carrier surveys yearly, one at the beginning of the breeding season and one about 1 to 2 months later may give data on production.

6. Flocks of four or more doves observed during the regular performance of their duties were reported by game research and management personnel of the Wisconsin Conservation Department.

7. A total of 307 such observations showed peak premigratory populations in late August and early September and showed a geographical range of abundance in the state similar to that shown by the mail-carrier counts.

8. The possibilities of using this system as a population index should be explored in the future.

FIGURE 3

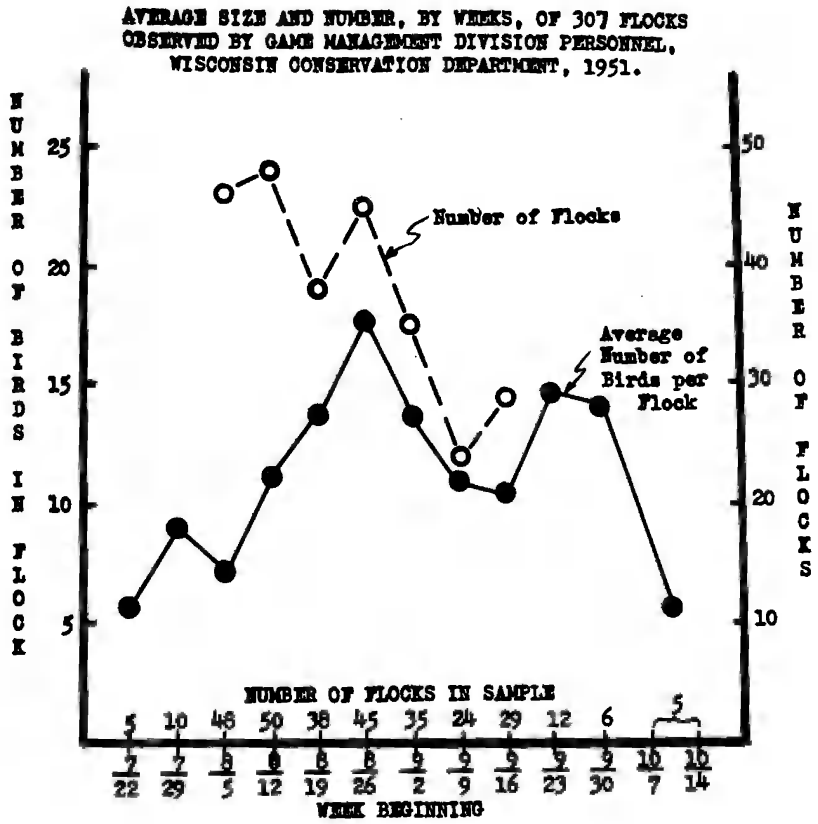
AVERAGE SIZE AND NUMBER, BY WEEKS, OF 307 FLOCKS OBSERVED BY GAME MANAGEMENT DIVISION PERSONNEL, WISCONSIN CONSERVATION DEPARTMENT, 1951.
NUMBER OF BIRDS IN FLOCK
25
20
15
10
5
50
40
30
20
10
NUMBER OF FLOCKS
Number of Flocks
Average Number of Birds per Flock
NUMBER OF FLOCKS IN SAMPLE
5 10 46 50 38 45 35 24 29 12 6 5
7/22 7/29 8/5 8/12 8/19 8/26 9/2 9/9 9/16 9/23 9/30 10/7 10/14
WEEK BEGINNING

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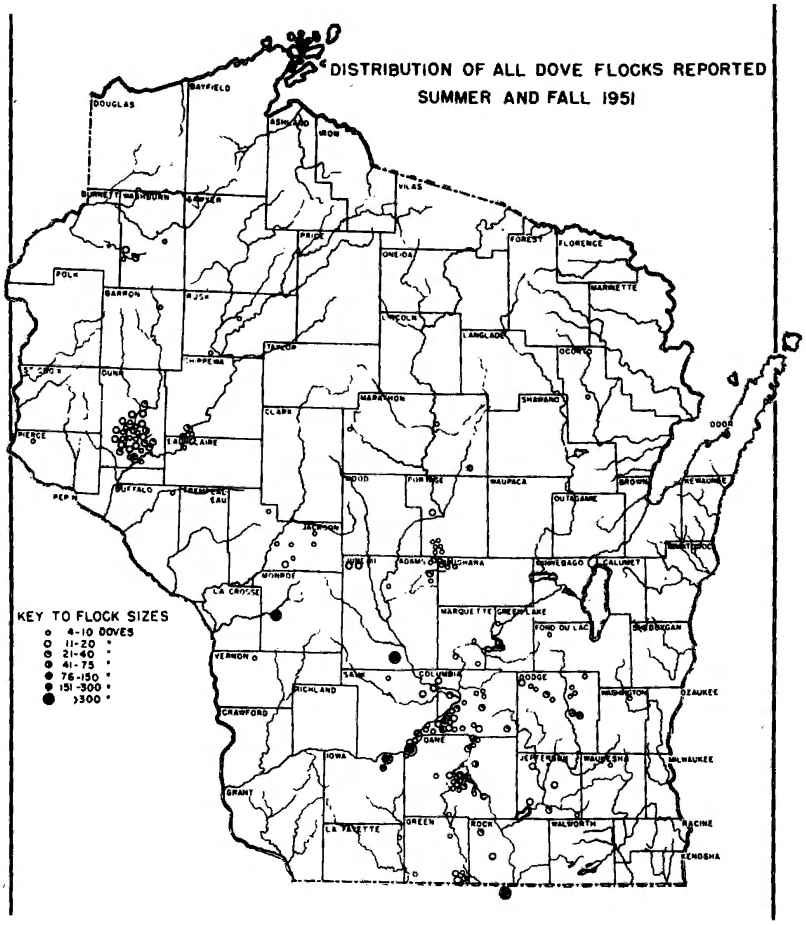
FIGURE 4



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